

2005 Performance Report

General Chemistry and Microbiology Section

June, 2006

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2005 PERFORMANCE REPORT

GENERAL CHEMISTRY AND MICROBIOLOGY SECTION

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and
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Laboratory Services Branch

Ontario Ministry of the Environment

June 2006

INTRODUCTION

The General Chemistry and Microbiology Section (GCMS) is part of the Ministry of the Environment's Laboratory Services Branch. The section is comprised of two units, the Water Chemistry and Microbiology Unit. The Water Chemistry Unit identifies and provides quantitative analysis for major ions, nutrients, and physical properties in a variety of matrices. The Microbiology Unit identifies and enumerates indicator bacteria of water and waste waters.

This report provides a brief outline of the analytical quality control (QC) program associated with sample analysis and examines 2005 performance data for each test in the Water Chemistry and Microbiology Units. GCMS strives to maintain a high standard of analytical performance through its quality assurance program. QC is an integral part of this process.

Some changes have taken place in the General Chemistry and Microbiology Section since the 2004 performance report was issued. The following describes those changes.

METHOD IMPLEMENTED BY GCMS in 2004

Bacillus thuringiensis israelensis (Bti) (E3451)
Bacillus thuringiensis israelensis (Bti) (E3452)
Escherichia coli (EC) (E3433)

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1.0 PERFORMANCE REPORT FORMAT

The parameters are those analysed by the GCMS for 2005.

The performance report is organized alphabetically according to test name (eg. Dissolved Organic Carbon is filed under the heading "Carbon, Dissolved Organic") and second, by the method reference number. Detailed information concerning the format of each page is outlined below:

1.1 TEST DESCRIPTION

TITLE:	The name of the test parameter.
IDENTIFICATION: Laboratory	Location where the test is performed.
Method Reference No:	A number assigned by the Quality Management Unit to an analytical test method eg.(E3370).
Product Code:	LIMS code for analysis request.
Sample Type/Matrix:	The various sample types that can be routed to the method.
Method Introduced:	Date that the method was implemented at the laboratory.
Reporting Units:	Unit of measurement in which the results are reported.
Supervisor/Scientist:	Name of supervisor/scientist responsible for the method.

SAMPLING:

The type of container and preservative (if applicable) that is used and minimum volume of sample that is usually required. Any sample preparation that is normally performed in the field, is also indicated (1).

SAMPLE PREPARATION:

Sample preparation techniques which are usually performed at the laboratory before analysis.

ANALYTICAL PROCEDURE:

Brief summary of the analytical method used to determine the parameter.

INSTRUMENTATION:

Type of instrumentation used to perform the test. Examples: Automated continuous flow systems consist of a sampler, peristaltic pump, manifold for reagent addition, detection system and readout system. Personal computers are used to control the operation of analytical equipment and/or data acquisition.

REPORTING:

W and T are method attributes that can be used to qualify low level data (2). A value reported with the qualifier <=W indicates no measurable response was observed under the conditions of the test and the value accompanying the remark is the lowest reportable value of the method. A value reported as <T is interpreted as a measurable trace amount of the constituent, but under the conditions of the test are not satisfactorily verifiable. Interpret data with caution. When dilutions are required, WE and TE are used as data qualifiers to indicate that the smallest measurable amount (W) and the limit of reliability (T) respectively has increased proportionately to the level of dilution.

To provide a consistent LSB approach to data reporting, GCMS calculates W, the minimum reporting value, from the standard deviation of duplicates (S_2), near zero, by rounding down to the nearest 1,2 or 5 digit (4). T is the method detection limit and is five times W. The latest calculations, valid at the date of publication for W and T values of all active methods, are contained in this report (APPENDIX A).

CALIBRATION:

The number of standards used to calibrate the analytical system plus blanks if applicable.

CONTROLS:

The calibration, drift, recovery, and interference controls that are used when applicable to ensure that the system is operating properly.

MODIFICATIONS:

Modifications made to the test in 2005.

NOTES:

Explanatory notes which may aid the data user in interpreting results and information.

1.2 PERFORMANCE DATA SUMMARY

QUALITY CONTROL DATA FROM/TO: (Optional)

The period of time over which data was collected.

ANALYTICAL RANGE AND REPORTING UNIT:

The full scale value for the analytical range is given in concentration units.

CALIBRATION CONTROL:

Calibration control includes a table outlining the number of data collected over the selected time period, expected concentrations of the control standards, the calculated mean concentration of these standards, mean bias (mean concentration minus the expected concentration), and standard deviations of each control standard. The between run standard deviation (S), the within run standard deviation (S_w), the ratio S/S_w, and the historical control limits for standards sums and differences are provided.

RECOVERIES (Where applicable):

The table outlines the number of data collected over the selected time period, expected concentrations of the recovery standards, the calculated mean concentration of these standards, and standard deviations of each recovery standard.

DUPLICATES:

The table outlines within run duplicate data collected over the selected time period. Data is sorted into a number of concentration spans. The standard deviation for duplicates is provided for each range. The coefficient of variation (%) is determined by dividing the mean standard deviation (S_2) for a particular concentration span by the mean concentration of duplicate results in that span and multiplying by 100.

OTHER CHECKS (Where applicable):

The table outlines the number of data collected over a selected time period, the calculated mean concentration and standard deviation.

1.3 QUALITY CONTROL GRAPHICS

CALIBRATION CONTROL:

Calibration control standards sums and differences are plotted for the period of data collection (referred to on the graphs as "QUALITY CONTROL STANDARD A+B" for example). The vertical scale consists of the warning/control limits expressed on either side of the expected value. These limits were chosen from analytical performance data.

NOTE:

DATE FORMAT:

mm/dd/yy

2.0 ANALYTICAL QUALITY CONTROL PROGRAM

Quality control is a continuous process that involves constant checks of sample processing procedures. This report summarizes the QC data collected during analytical processing to monitor performance of the analytical system.

Calibration Standards are verified for identity, purity and concentration accuracy by comparison against independent sources wherever possible. Usually, a series of calibration standards are analyzed covering the analytical range.

Once a system has been calibrated, quality control begins. Depending on the analytical procedure, quality control may be used to evaluate: calibration, blank, recovery, sensitivity, potential interference, and sample repeatability.

Calibration and Blank

Calibration is controlled by a minimum of two quality control standards and usually a long term blank which are prepared and maintained independently of the calibration standards. The system is not calibrated with the quality control standards. The long term blank is Pure De-ionized Water (Pure-DW) used to prepare the quality control standards and has zero concentration of the target analyte. Control standards are prepared less frequently than calibration standards, thus allowing an independent cross check of the newly prepared calibration standards. When control standards are prepared, they are checked over three consecutive runs and must be within the warning limits (two standard deviations of theoretical value) before routine use.

The standard deviation of the control standards is used to estimate the between-run standard deviation (S) and is compared against the within-run standard deviation (S_w). If the ratio S/S_w exceeds 1.5 then poor control of systematic error can be inferred (3). Values for S and S_w are calculated as follows:

$$2S^2 = (S_A)^2 + (S_B)^2 \quad 2S_w^2 = (S_{A-B})^2$$

Where

S_A = standard deviation (s.d.) of control standard A

S_B = s.d. of control standard B

S_{A-B} = s.d. of the difference between control standards A and B

NOTE: If a second range is employed for a test, more control standards are used because, in many systems, the between-run standard deviations are concentration dependent.

Detailed description of the quality control processes are outlined in several LSB documents (2)(4)(5)(6) and (9).

Control/Warning Limits

The control standards data is assessed and compared against the control/warning limits established from previous data to determine whether the calibration process is in control. The limits are set up initially based on method performance(4), and are reviewed when method and/or performance data reviews are conducted to determine if modifications are required based on historical data calculations. Control limits are calculated for the sums and differences of control standards (A,B,C,D) by the equations:

$$(A+B) \pm 4(S_{A+B}) \text{ for the sum of } A+B$$

$$(B+C) \pm 4(S_{B+C}) \text{ for the sum of } B+C$$

$$(C+D) \pm 4(S_{C+D}) \text{ for the sum of } C+D$$

$$(A-B) \pm 3(S_{A-B}) \text{ for the difference of } A-B$$

$$(B-C) \pm 3(S_{B-C}) \text{ for the difference of } B-C$$

$$(C-D) \pm 3(S_{C-D}) \text{ for the difference of } C-D$$

Note: Warning Limits are calculated by the same formulae above (using ± 2 instead of 4 and 3 respectively).

If a control limit is exceeded, the analysis is stopped, and corrective action is taken.

Recovery

Some methods require sample pre-treatment, such as digestion or extraction. A recovery check, suitable to that method, is required to estimate the efficiency of the pre-treatment. Recovery standards are usually prepared at 0%, 20% and 80% of full scale. The solutions are analysed in the same manner as routine samples. Although these solutions are not used to calibrate the instrument corrections for the blank are calculated and applied if necessary. For an analytical run to be accepted, the recoveries should be within ± 3 standard deviation of their expected values. (See Section 1.1 "Reporting" for T determination). The average blank should be within three standard deviations of its historical mean. If a second range is employed for a test, at least one additional recovery standard is used.

Sensitivity and Baseline

Any change in the sensitivity of the instrumentation is monitored periodically during the run ,as defined by the method, by analysing a standard that is usually 80% of full scale, and comparing the reading to the original calibration standards. Baseline drift is usually recorded by periodic analysis, as defined by the method, of Pure-DW which does not contain any of the analyte, but may be treated to correspond to sample pre-treatment.

Interference

The interference check is run on any test where a substance may be present in concentrations that affect the results. The check is carried out near the threshold concentration of the interfering substance, beyond which the methodological safeguards used to minimize the interference are no longer effective. The check indicates that the interference has no effect up to the specified concentrations.

Sample Repeatability

Generally, one sample out of twenty is analysed in duplicate up to a maximum of three duplicates per analytical run. The samples are selected for non-adjacent, within-run duplicate analyses. By analysing samples in duplicate, the ability of the analyst to obtain repeatable analytical results, within an analytical run, can be determined. For results to be acceptable, at least two of the three duplicate pairs must conform to limits that are set based on historical performance.

Duplicate data are accumulated and usually sorted into 3 ranges of 0-10 or 0-20, 21-50, 51-100 percent of full scale. More ranges may be added where the analytical scale spans are greater than 2 log scales. When less than 3 data pairs are collected, the remark N.A. (not available) is reported. A standard deviation is calculated for each concentration range. The limits are established at 3*S.D. The algorithm differs from the conventional standard deviation as follows:

Conventional Std. Dev. (1)*

$$S_1 = \sqrt{\frac{\sum_{i=1}^n (\bar{x} - x_i)^2}{n-1}}$$

Within-run Std. Dev. of Duplicates (2)*

$$S_2 = \sqrt{\frac{\sum_{i=1}^{n'} (x_1 - x_2)_i^2}{2n'}}$$

* Standard deviations used for the data summaries.

Where S_1 = sample standard deviation
 S_2 = duplicate difference standard deviation
 n = number of data
 \bar{x} = mean of data
 x_i = ith result
 $(x_1 - x_2)_i$ = difference of the ith duplicate
 n' = number of duplicate pairs

The standard deviation (S_2) of the duplicate difference is also expressed as the coefficient of variation (CV).

$$CV = \frac{S_2}{\bar{X}} \times 100$$

2.1 PERFORMANCE SUMMARIES

ALKALINITY, TOTAL FIXED ENDPOINT

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No.	E3218	Reporting Unit	mg/L as CaCO ₃
LIMS Product Code	PHALCO3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

Samples (20.0 mL) are titrated with 0.02 N sulphuric acid to pH endpoint of 4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant. pH, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
--------------------------------	----------------------	----------------------

STANDARDIZATION:

Titrant, 0.02N sulphuric acid, is standardized.

CONTROLS:

Standardization and checks	BL plus 4 standards, e.g. QCA
Drift	In run standards throughout the run (tap water diluted to 50% V/V)

NOTES:

May '97 the W value was changed from 0.2 to 0.5 after a review of 2 years low level duplicate data '94-95.

ALKALINITY, TOTAL FIXED ENDPOINT (E3218)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/22/05

Analytical Range: to 1000 mg/L as CaCO₃

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	130	250	249.86	-0.14	1.8685
B:	130	100	100.01	0.01	0.9508
C:	130	25	24.94	-0.06	0.4633
D:	130	2.5	2.49	-0.01	0.1361
A+B:		350	349.86	-0.14	2.5252
A-B:		150	149.85	-0.15	1.5537
B+C:		125	124.95	-0.05	1.2032
B-C:		75	75.06	0.06	0.8887
C+D:		27.5	27.43	-0.07	0.4844
C-D:		22.5	22.45	-0.05	0.4814

s.d.(AB)	S(between runs): 1.48	Sw(within run): 1.10	S/Sw: 1.3
s.d.(BC)	S(between runs): 0.75	Sw(within run): 0.63	S/Sw: 1.2
s.d.(CD)	S(between runs): 0.34	Sw(within run): 0.34	S/Sw: 1.0

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

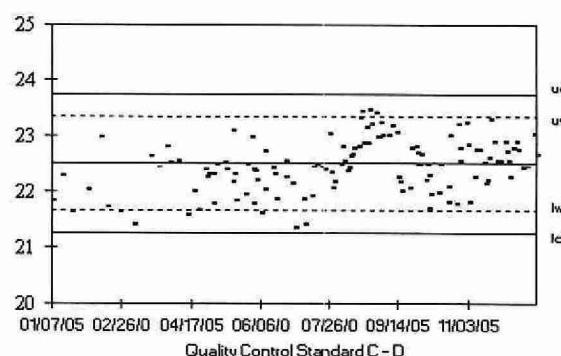
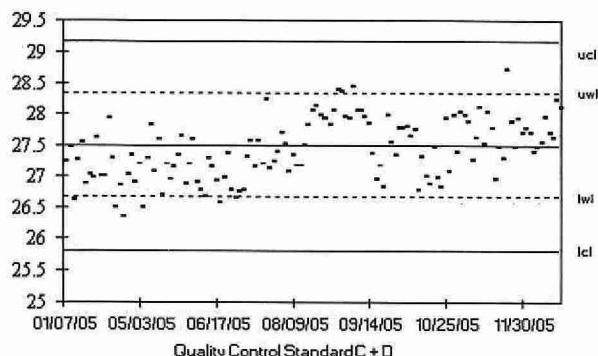
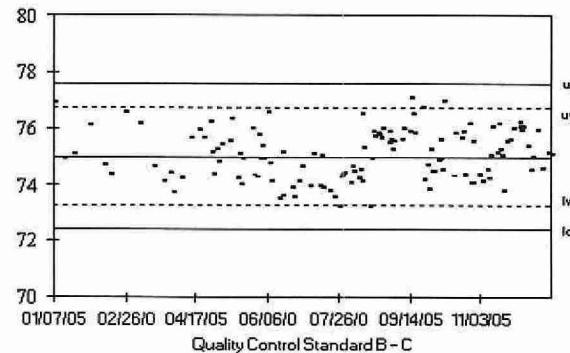
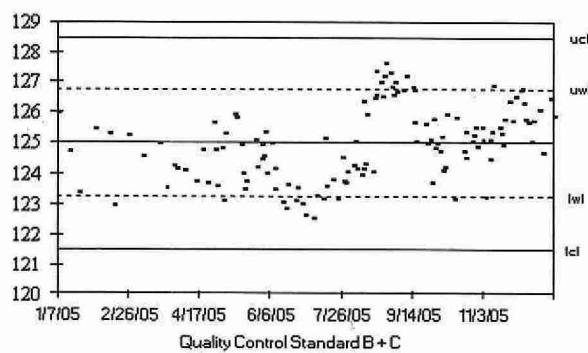
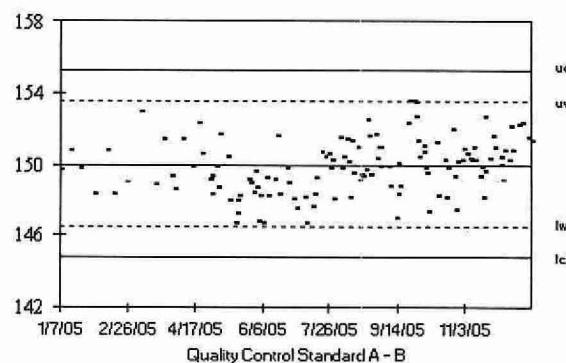
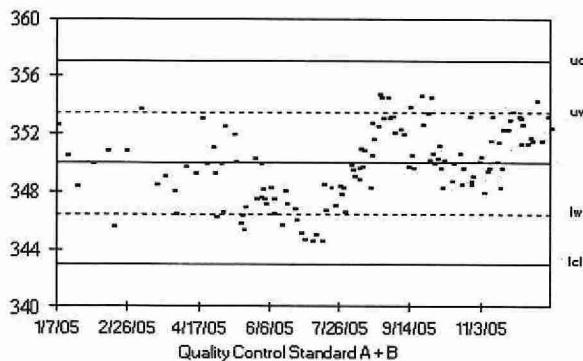
343	-	357	for A+B
144.75	-	155.25	for A-B
121.5	-	128.5	for B+C
72.4	-	77.6	for B-C
25.82	-	29.18	for C+D
21.24	-	23.76	for C-D

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
85	0 - 50	0.7645	3.0
85	51 - 100	0.5164	0.7
179	101 - 300	1.4648	0.7
21	301 - 1000	3.7134	1.0
370	Overall	1.4199	

ALKALINITY, TOTAL FIXED ENDPOINT (E3218)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/22/05
Analytical Range: to 1000 mg/L as CaCO₃



BROMATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	$\mu\text{g/L}$ as BrO_3^-
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), bromide and bromate are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by an conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in $\mu\text{g/L}$ as Br^- & BrO_3^- is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module, a postcolumn delivery system (pneumatically controlled), a heated postcolumn reaction coil, a conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g., QCA
Drift	In run standards every 10 samples
Recovery	BL and samples spiked with 5 $\mu\text{g/L}$ Bromate solution

BROMATE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 12/07/05

Analytical Range: to 15.00 µg/L as BrO₃**CALIBRATION CONTROL:**

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	44	12	12.0316	0.0316	0.1422
B:	44	3	2.9954	-0.0046	0.1085
A+B:		15	15.0270	0.0270	0.1875
A-B:		9	9.0362	0.0362	0.1698

s.d.(AB) S(between runs): 0.1265 Sw(within run): 0.1200 S/Sw: 1.05

The calibration is accepted if the calibration control values obtained lie within the ranges:

$$\begin{array}{ccccc} 14.3596 & - & 15.6404 & \text{for} & A+B \\ 8.5197 & - & 9.4803 & \text{for} & A-B \end{array}$$

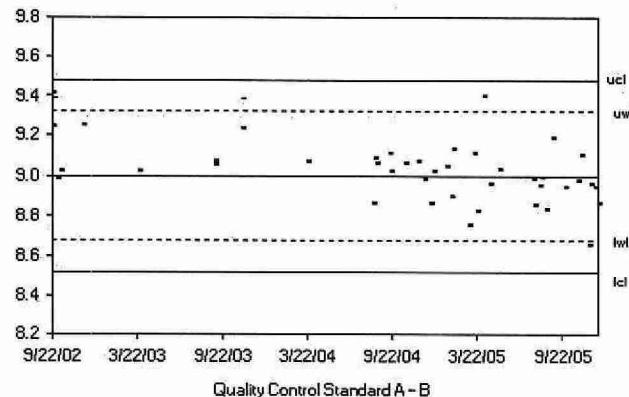
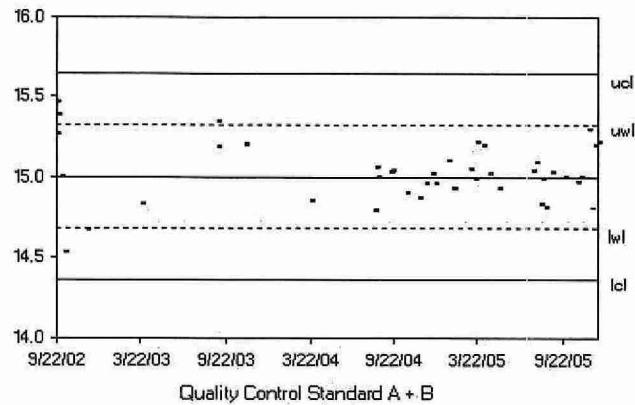
OTHER CHECKS: (August 2004 to December 2005)

	n	Expected	Mean	Standard Deviation (1)
Spike Recovery (5 µg/L)	68	5	4.9891	0.3386
Long Term Blank	22	0	0.0203	0.0464

BROMATE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 12/07/05

Analytical Range: to 15.00 µg/L as BrO₃



BROMIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as Br ⁻
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), bromide and bromate are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by an conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as Br⁻ & BrO₃⁻ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module, a postcolumn delivery system (pneumatically controlled), a heated postcolumn reaction coil, a conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g., QCA
Drift	In run standards every 10 samples

BROMIDE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 12/07/05

Analytical Range: to 30.00 µg/L as Br

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	63	24	24.0457	0.0457	0.2369
B:	63	6	5.9880	-0.0120	0.2799
A+B:		30	30.0336	0.0336	0.3480
A-B:		18	18.0577	0.0577	0.3845

s.d.(AB) S(between runs): 0.

Sw(within run): 0.27

S/Sw: 1.14

The calibration is accepted if the calibration control values obtained lie within the ranges:

27.2917 - 32.7083 for A+B
 15.9687 - 20.0313 for A-B

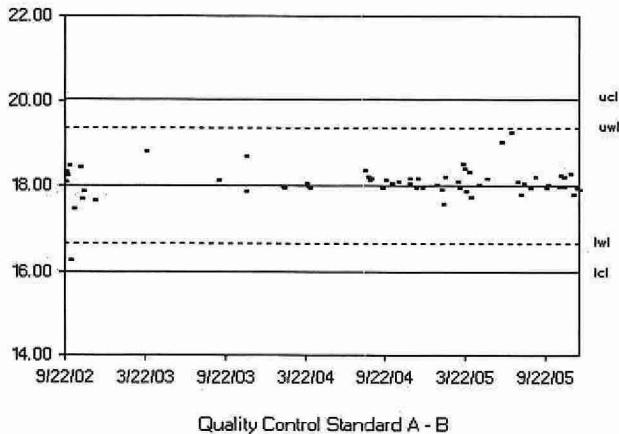
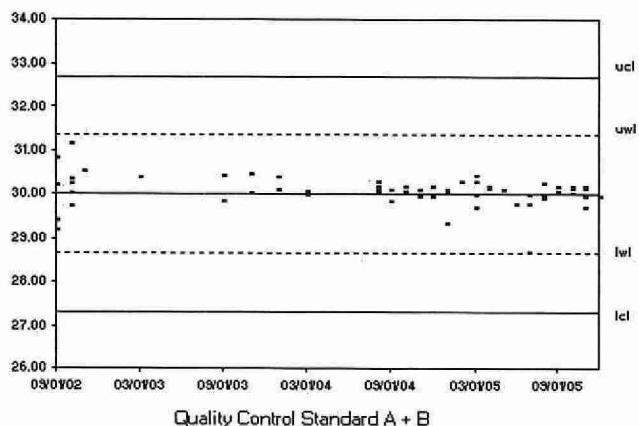
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	45	0.0603	0.16639

BROMIDE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 12/07/05

Analytical Range: to 30.00 µg/L as Br



CARBON, DISSOLVED INORGANIC

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample.

Approximate absorbance: 0.3 at the full scale level.

Dissolved organic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO_2 -free) supply, dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by "Labtronics" Data Aquisition software.

Carbon; dissolved inorganic (E3370)

Analytical Range: to 80 mg/L as C

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	56	64	63.692	-0.308	0.772
B	56	16	15.796	-0.204	0.364
C	56	4	4.096	0.096	0.217
A + B		80	79.488	-0.512	0.963
A - B		48	47.896	-0.104	0.727
B + C		20	19.892	-0.108	0.479
B - C		12	11.7	-0.3	0.359

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.6032
	Within Runs	0.5141
	Between/Within	1.1733
s.d.(BC)	Between Runs	0.2992
	Within Runs	0.2539
	Between/Within	1.1784

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	81.07	78.93	82.14	77.86
A - B	49.07	46.93	49.6	46.4
B + C	20.58	19.42	21.1	18.8
B - C	12.58	11.42	12.88	11.12

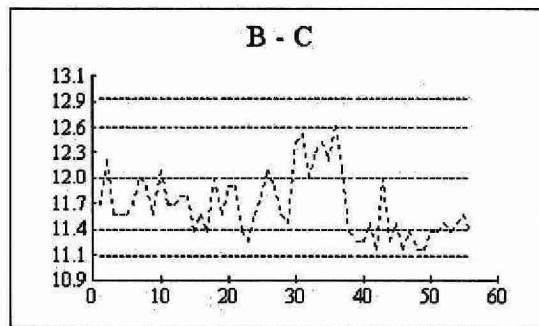
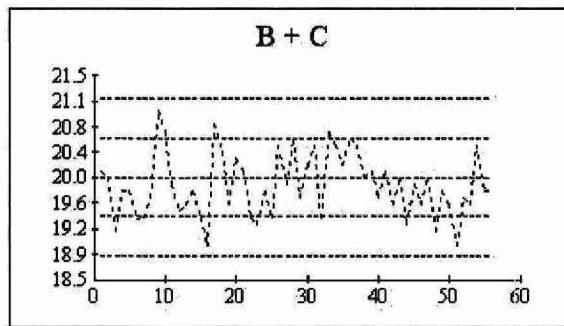
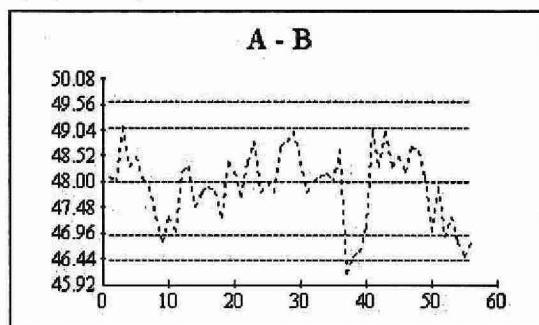
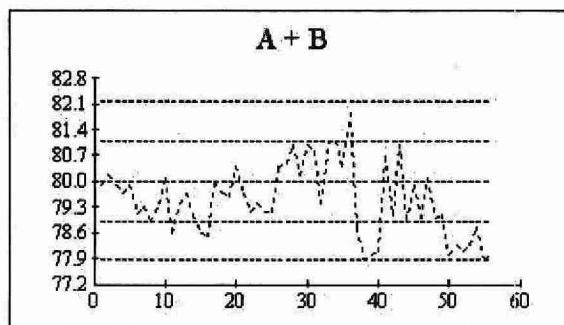
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
21	0 - 10%	0.255	8.9
18	10 - 20%	0.352	3.1
89	20 - 50%	0.277	1.2
33	50 - 100%	0.458	0.8
161	Total	0.329	1.3

Other Checks	Number	Mean	Std. Dev.
LTB	56	0.121	0.246

Carbon; dissolved inorganic (E3370A)

QC Data: 2005/1/1 to 2005/12/31



CARBON, DISSOLVED ORGANIC

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Using an automated system, the supernatant from a settled sample is acidified and flushed with nitrogen gas to remove inorganic carbon. Organic carbon is then oxidized to carbon dioxide gas by exposure to ultra-violet light (UV) in acid-persulphate media. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved organic carbon content of the sample. Approximate absorbance: 0.3 at the full scale level. Dissolved inorganic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: nitrogen and air (CO_2 -free) supplies with flow controls, dialysis unit, UV digestor. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1	Current T value: 0.5
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by "Labtronics" Data Aquisition software.

Carbon; dissolved organic (E3370)

Analytical Range: to 20 mg/L as C

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	57	16	16.07	0.07	0.099
B	57	4	4.031	0.031	0.145
C	57	1	1.001	0.001	0.099
A + B		20	20.101	0.101	0.193
A - B		12	12.04	0.04	0.156
B + C		5	5.031	0.031	0.209
B - C		3	3.03	0.03	0.132

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.1241
	Within Runs	0.1103
	Between/Within	1.1251
s.d.(BC)	Between Runs	0.1237
	Within Runs	0.0933
	Between/Within	1.3258

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	20.28	19.72	20.56	19.44
A - B	12.28	11.72	12.42	11.58
B + C	5.22	4.78	5.44	4.56
B - C	3.22	2.78	3.33	2.67

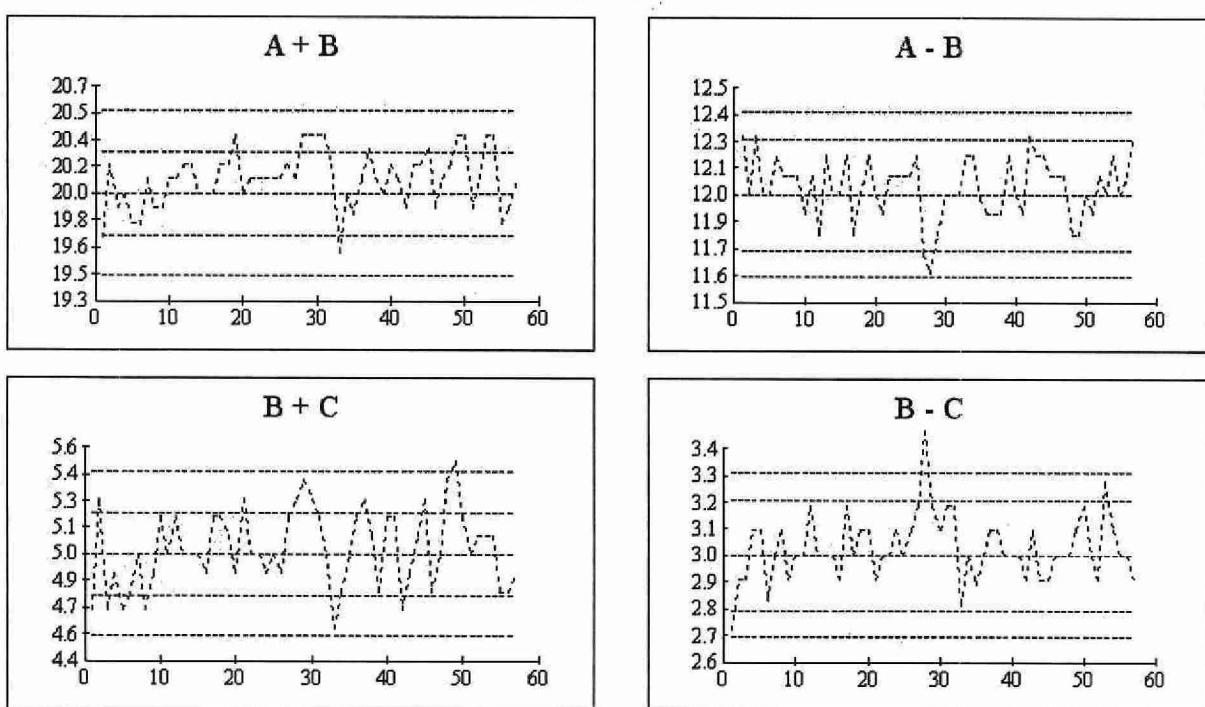
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
56	0 - 10%	0.083	5.9
40	10 - 20%	0.351	11.7
62	20 - 50%	0.104	1.7
5	50 - 100%	0.055	0.5
163	Total	0.192	5

Other Checks	Number	Mean	Std. Dev.
LTB	57	-0.047	0.282

Carbon: dissolved organic (E3370A)

QC Data: 2005/1/1 to 2005/12/31



CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Reporting Unit	$\mu\text{g}/\text{m}^3$ as Cl
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" filter strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation. The result is reported as $\mu\text{g}/\text{m}^3$ as Cl. Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1 $\mu\text{g}/\text{m}^3$	Current T value: 0.5 $\mu\text{g}/\text{m}^3$
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CALIBRATION:

9 standards

CONTROLS:

Calibration	MB, CS1, and CS2, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

CHLORIDE cont'd

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of Cl in $\mu\text{g}/\text{m}^3$ is calculated by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

CHLORIDE (E3004)

QUALITY CONTROL DATA FROM 01/12/04 TO 12/22/05

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	50	80	79.9239	-0.0761	0.2560
B:	50	20	19.6098	-0.3902	0.4552
A+B:		100	99.5337	-0.4663	0.4410
A-B:		60	60.3142	0.3142	0.5925

s.d.(AB) S(between runs): 0.37 Sw(within run): 0.42 S/Sw: 0.88

The calibration is accepted if the calibration control values obtained lie within the ranges:

96.71 - 103.29 for A+B
57.54 - 62.46 for A-B

In House Control standard data for 01/12/04 to 12/22/05:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
CS4	49	3.09	3.11	0.02	0.1673
CS5	47	19.19	18.86	-0.33	0.5358

The standards are accepted if the control values obtained lie within the ranges:

2.41 - 3.77 for CS4
18.13 - 20.14 for CS5

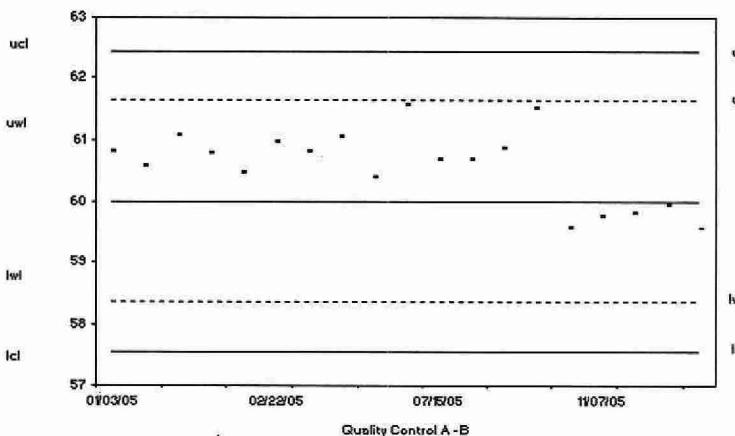
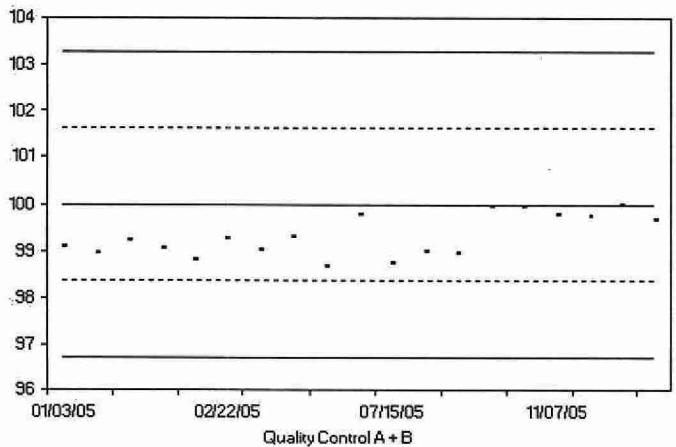
DUPLICATES (2005): ($\mu\text{g}/\text{m}^3$)

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
46	0.0 - 2.86	0.0570	19.1
2	2.89 - 7.15	N.A.	N.A.
0	7.18 - 14.31	N.A.	N.A.
0	14.33 - 28.61	N.A.	N.A.
48	Overall	0.1056	

CHLORIDE (E3004)

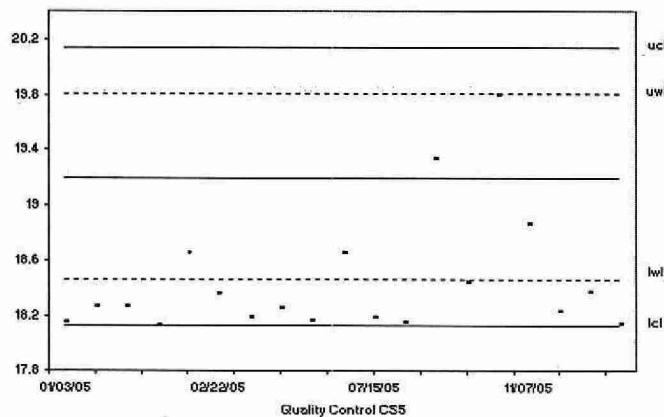
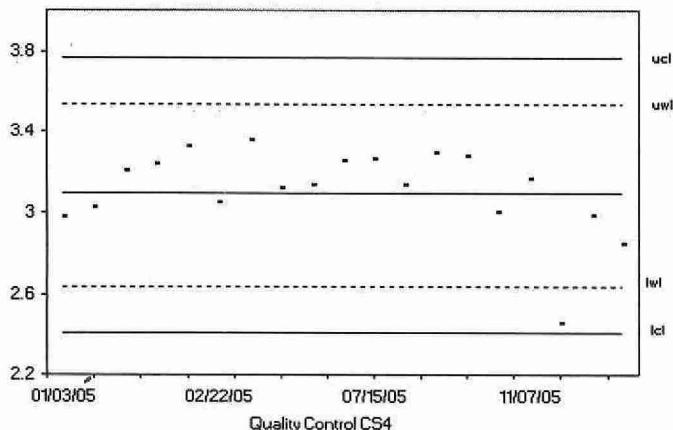
QUALITY CONTROL DATA FROM 01/03/05 TO 12/22/05

Analytical Range: to 100 mg/L



QUALITY CONTROL DATA FROM 01/03/05 TO 12/22/05

Analytical Range For CS Controls: to 28.61 $\mu\text{g}/\text{m}^3$



CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Reporting Unit	µg/g as Cl
LIMS Product Code	ANION3013, CL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic

SAMPLING PREPARATION:

A 3.0g sample of air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The result is reported as µg/g as Cl.
Sulphate is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g
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CALIBRATION:

9 standards

CONTROLS:

Calibration	MB, CS1, CS2, QCA and QCB
Recovery	R21, SO201 and SO202
Drift	2 standards every 20 samples

Note: R21, SO201 and SO202 were introduced October, 2003.

CHLORIDE (E3013)

QUALITY CONTROL DATA FROM 06/25/03 TO 12/22/05

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	37	80	79.69	-0.31	0.4927
B:	37	20	19.94	-0.06	0.5063
A+B:		100	99.62	-0.38	0.4449
A-B:		60	59.75	-0.25	0.8945

s.d.(AB) S(between runs): 0.50 Sw(within run): 0.63 S/Sw: 0.80

$S_w(\text{within run})$: 0.63

S/Sw: 0.80

The calibration is accepted if the calibration control values obtained lie within the ranges:

96.71 - 103.29 for A+B
 57.54 - 62.46 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span ($\mu\text{g/g}$)	Standard Deviation (2)	Coefficient of variation(%)
12	0.0 - 200	0.1874	0.2
2	201 - 500	N.A.	N.A.
0	500 - 1000	N.A.	N.A.
14	Overall	0.0520	

Note: No duplicate data for 2004.

RECOVERIES:

	n Data Pairs	Expected Concentration	Mean Concentration	Standard Deviation (1)
R21	13	16.9	14.20	1.2149
SO201	13	33	28.25	1.8215
SO202	13	3.3	2.68	0.6854

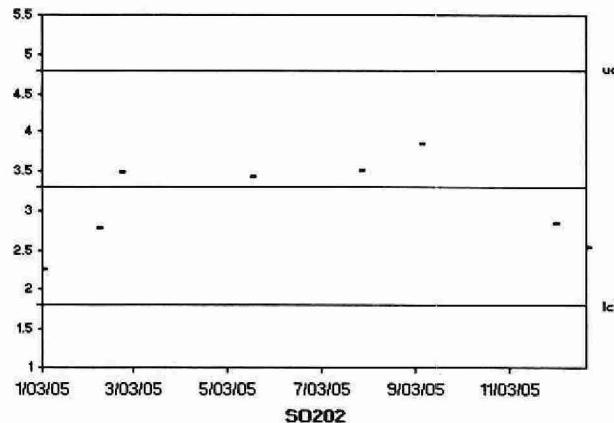
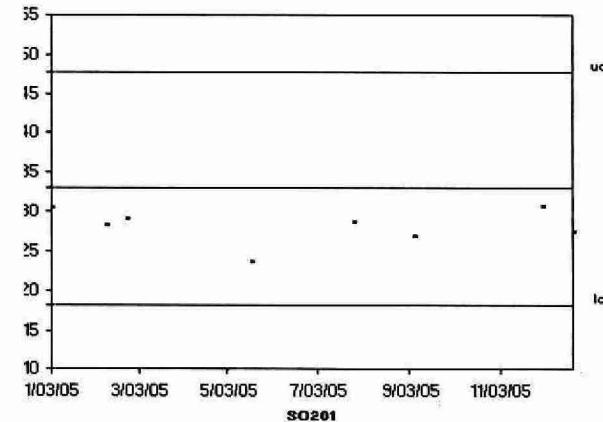
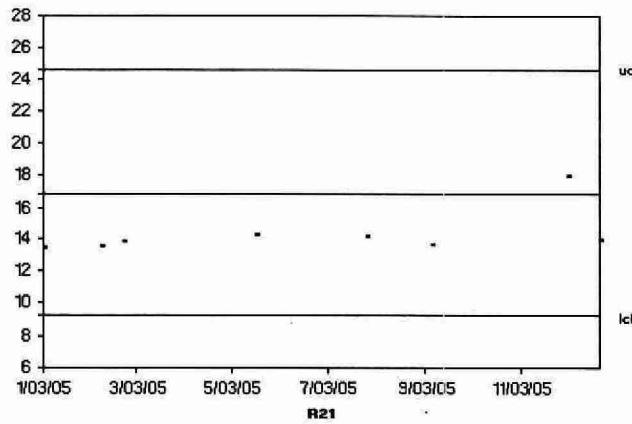
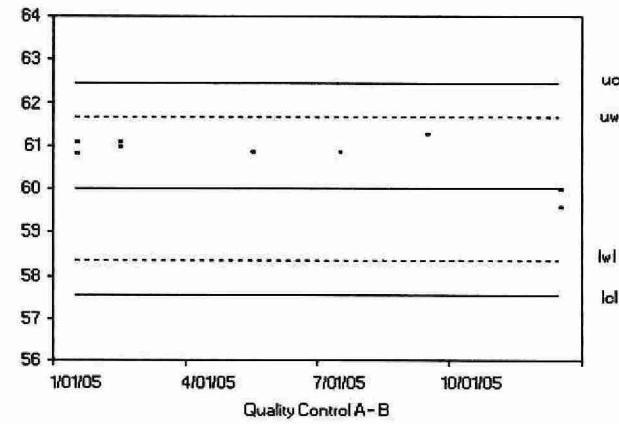
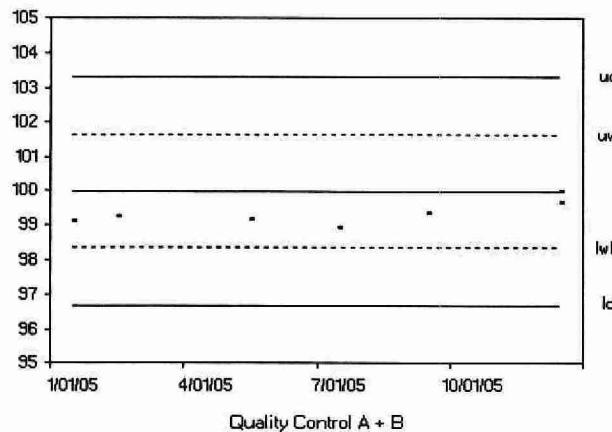
The calibration is accepted if the calibration control values obtained lie within the ranges:

9.3	-	24.5	for	R21
18.2	-	47.9	for	SO201
1.8	-	4.8	for	SO202

CHLORIDE (E3013)

QUALITY CONTROL DATA FROM 01/03/05 TO 12/22/05

Analytical Range: to 100 mg/L



CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/05/75
Method Reference No.	E3016	Reporting Unit	mg/L as Cl
LIMS Product Code	CL3016	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	10 mL
Container:	Plastic

ANALYTICAL PROCEDURE:

Chloride ions are combined with mercuric thiocyanate releasing thiocyanate quantitatively. Thiocyanate then reacts with ferric ions to produce ferric thiocyanate (red), and the absorbance of the latter is measured colourimetrically.

Approximate absorbance: 0.5 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 1.5 cm light path at 480 nm.

Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 12 standards

CONTROLS:

Calibration:	LTBL plus 3 standards, e.g. QCA
Drift:	BL and standard after every 12 samples

NOTES:

April 1998: The HP data capture/processing system was replaced by "Labtronics" Data Aquisition software. Two additional Calibration standards were added at the low end of the curve.

Chloride (E3016)**Analytical Range: to 100 mg/L as Cl****Calibration Control:**

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	78	75	75.4118	0.4118	0.335
B	78	25	25.1386	0.1386	0.1777
C	78	5	4.9041	-0.0959	0.0945
A + B		100	100.5504	0.5504	0.4503
A - B		50	50.2732	0.2732	0.2912
B + C		30	30.0427	0.0427	0.2388
B - C		20	20.2345	0.2345	0.155

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.2681
	Within Runs	0.2059
	Between/Within	1.3021
s.d.(BC)	Between Runs	0.1423
	Within Runs	0.1096
	Between/Within	1.2984

Control Limits

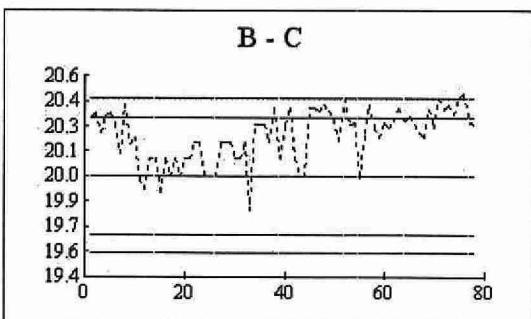
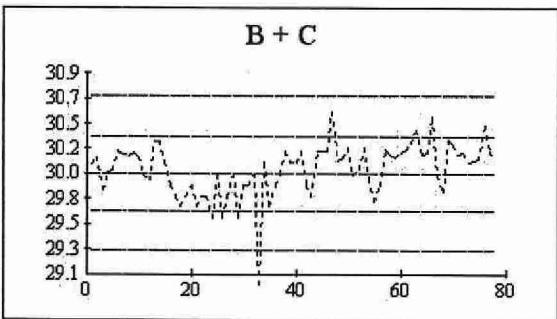
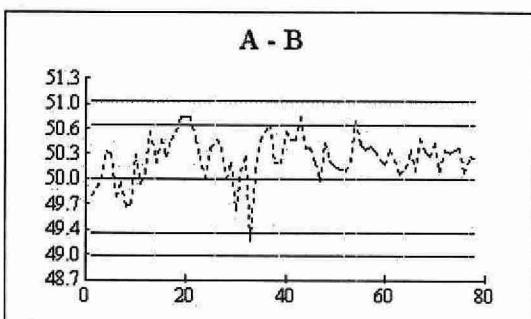
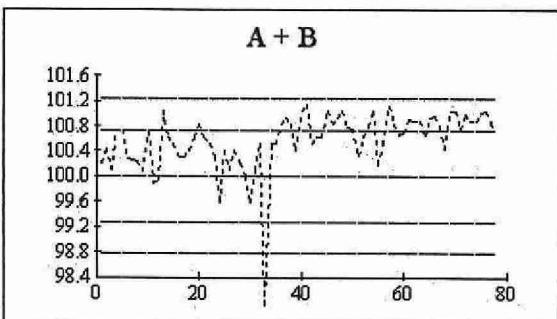
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	100.7	99.3	101.3	98.7
A - B	50.7	49.3	51	49
B + C	30.34	29.66	30.7	29.3
B - C	20.34	19.66	20.5	19.5

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
44	0 - 10%	0.106	2.1
38	10 - 20%	0.125	0.8
75	20 - 50%	0.203	0.7
44	50 - 100%	0.505	0.7
201	Total	0.277	0.9

Other Checks	Number	Mean	Std. Dev.
LTB	78	0.0374	0.0651

Chloride [E3016A]
QC Data: 2005/01/01 to 2005/12/31



CHLOROPHYLL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/75
Method Reference No	E3169	Reporting Unit	µg/L
LIMS Product Code	CHL3169	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	1000 mL for clear samples; 500 mL if visibly green
Container	Glass or plastic
Other	In the field a sample is filtered through a nylon filter. The filter is folded and then placed between two membrane filter-support pads, and the package is enclosed in a plastic dish labelled with the sample number and sample volume filtered, the dish is kept in the dark or wrapped in aluminum foil, and shipped immediately, or kept frozen.

ANALYTICAL PROCEDURE:

Chlorophyll 'a', chlorophyll 'b', and corrected chlorophyll 'a' (for pheophytin 'a') are determined by the extraction of the pheopigments into an acetone-water solvent followed by two computer controlled spectrophotometric scans with measurements at 630, 645 and 663 (665 for acidified) nm absorbance measurements. Also, the minimum absorbance between 710 and 750 is measured to allow for a correction due to turbidity. SCOR-UNESCO equations are used for all chlorophyll calculations.

INSTRUMENTATION:

- Automated modular continuous flow scanning spectrophotometer system
- Computer system for control of sampling, timing and data processing (i.e. data capture, calculations and transfer of results to LIMS)

REPORTING:

Chlorophyll a; corrected Chlorophyll a; total Chlorophyll b; total	Maximum Significant Figures: 3	Current W value: 1.0 Current W value: 0.2 Current W value: 0.1	Current T value: 5.0 Current T value: 1.0 Current T value: 0.5
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CONTROLS:

Calibration	LTBL plus 2 "standards", e.g.QCA
Drift	"standard", BL every 20 samples

NOTES:

"Standards" are prepared from chlorophyll "a" and "b", but the materials are neither analytical grade nor are their solutions stable. Thus calibration controls are based on measured averages.

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 01/12/05 TO 12/14/05

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	3.0	2.97	-0.03	0.0558
B:	47	1.0	1.07	0.07	0.0853
A+B:		4.0	4.03	0.03	0.1261
A-B:		2.0	1.90	-0.10	0.0816

s.d.(AB) S(between runs): 0.07 Sw(within run): 0.06 S/Sw: 1.2

The calibration is accepted if the calibration control values obtained lie within the ranges:

3.6 - 4.4 for A+B
1.7 - 2.3 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
45	0 - 5.0	0.0777	13.8
0	5.1 - 10.0	N.A.	N.A.
2	10.1 - 25.0	N.A.	N.A.
47	Overall	0.1315	

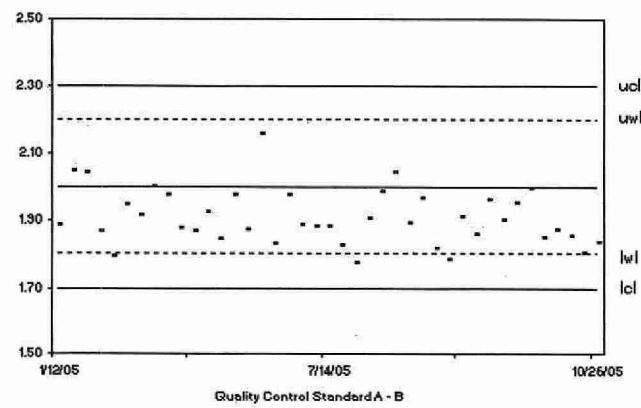
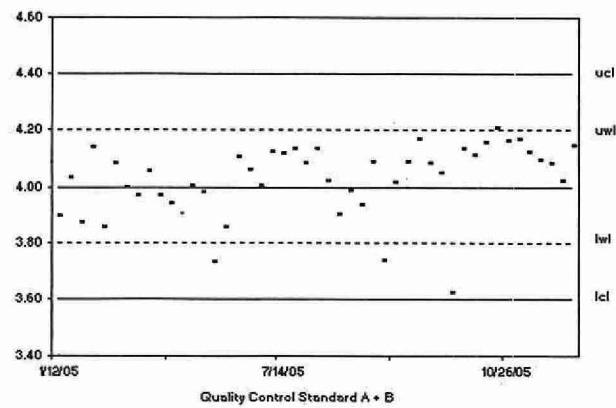
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	47	-0.0011	0.0506
Filtered Blank	47	0.0049	0.0181

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 01/12/05 TO 12/14/05

Reporting Unit: $\mu\text{g/L}$



CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 01/12/05 TO 12/14/05

Reporting Unit: $\mu\text{g/L}$ **CALIBRATION CONTROL:**

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	2.4	2.38	-0.02	0.0716
B:	47	0.8	0.80	0.00	0.0941
A+B:		3.2	3.17	-0.03	0.2192
A-B:		1.6	1.66	0.06	0.0962

s.d.(AB) S(between runs): 0.08

Sw(within run): 0.07

S/Sw: 1.23

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.4	-	4.0	for	A+B
1.0	-	2.2	for	A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
27	-0.5 - 1.0	0.1708	96.1
3	1.1 - 2.0	0.2358	19.4
2	2.1 - 5.0	N.A.	N.A.
1	5.1 - 10.0	N.A.	N.A.
2	10.1 - 100	N.A.	N.A.
35	Overall	0.2062	

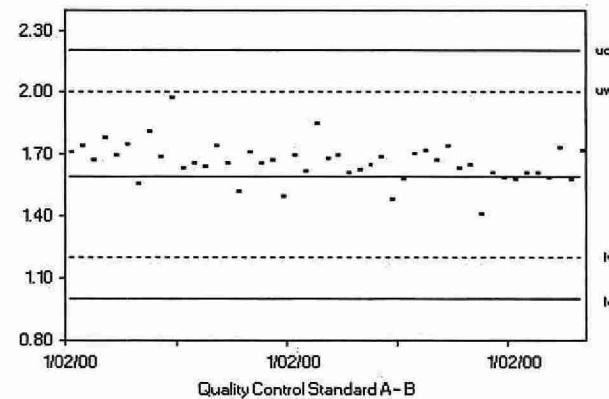
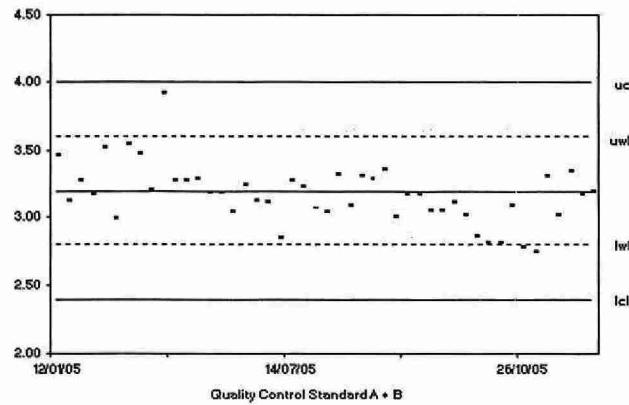
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	47	-0.0686	0.0535
Filtered Blank	47	-0.0717	0.0568

CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 01/12/05 TO 12/14/05

Reporting Unit: $\mu\text{g/L}$



CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 01/12/05 TO 12/14/05

Reporting Unit: $\mu\text{g/L}$

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	3.0	3.04	0.04	0.0649
B:	47	1.0	1.15	0.15	0.2885
A+B:		4.0	4.07	0.07	0.1031
A-B:		2.0	1.91	-0.09	0.0763

s.d.(AB) S(between runs): 0.21 Sw(within run): 0.05 S/Sw: 3.88

The calibration is accepted if the calibration control values obtained lie within the ranges:

3.6	-	4.4	for	A+B
1.7	-	2.3	for	A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
37	0 - 1.0	0.0350	36.4
3	1.1 - 2.0	0.2326	17.6
0	2.1 - 5.0	N.A.	N.A.
41	Overall	0.0815	

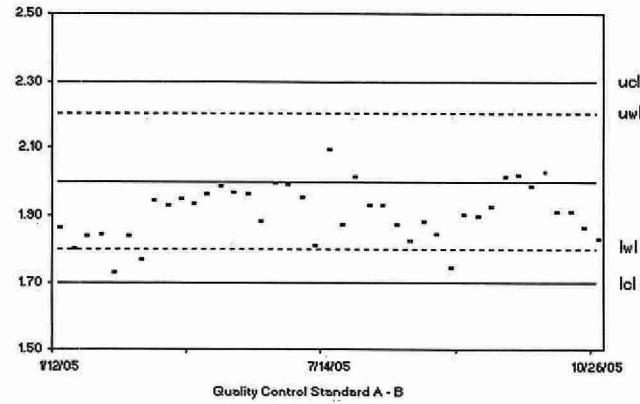
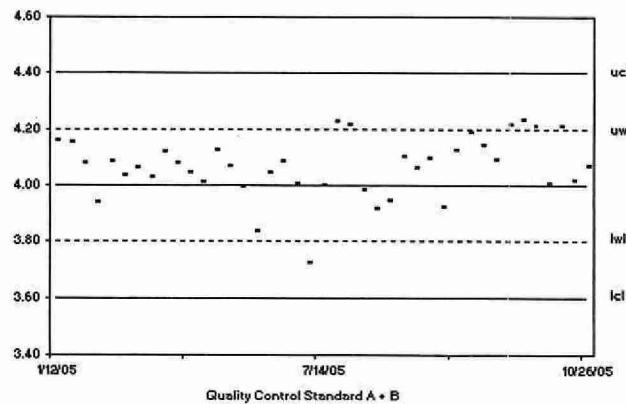
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	47	0.0071	0.0447
Filtered Blank	47	0.0065	0.0284

CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 01/12/05 TO 12/14/05

Reporting Unit: $\mu\text{g/L}$



COLOUR, TRUE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	13/03/84
Method Reference No.	E3219	Reporting Unit	TCU
LIMS Product Code	COL3219	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.

Approximate absorbance: 0.3 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450 nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740 nm). Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	BL and standard after every 10 samples

NOTES:

The HP data capture/processing system was replaced by "Labtronics" Data Aquisition software in November 1998.

Colour;true (E3219)

Analytical Range: to 100 TCU

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	40	70	70.4833	0.4833	0.4379
B	40	25	25.3945	0.3945	0.4329
C	40	7.5	7.14	-0.36	0.3341
A + B		95	95.8778	0.8778	0.7023
A - B		45	45.0888	0.0888	0.5148
B + C		32.5	32.5345	0.0345	0.6625
B - C		17.5	18.2545	0.7545	0.3988

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.4354
	Within Runs	0.364
	Between/Within	1.1962
s.d.(BC)	Between Runs	0.3867
	Within Runs	0.282
	Between/Within	1.3713

Control Limits

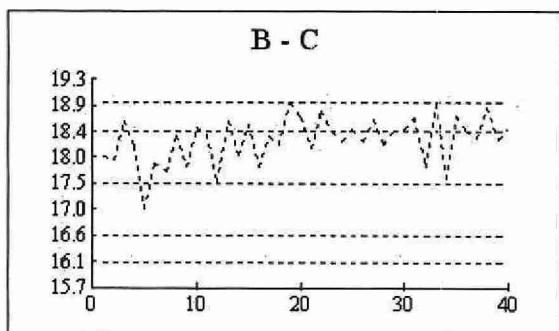
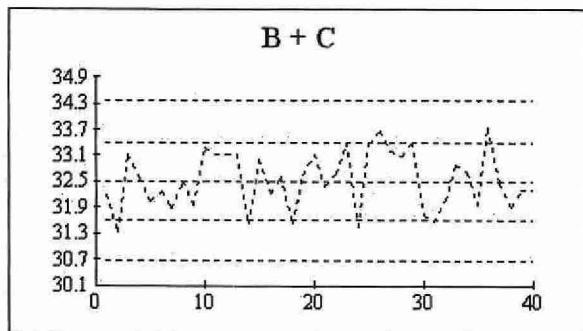
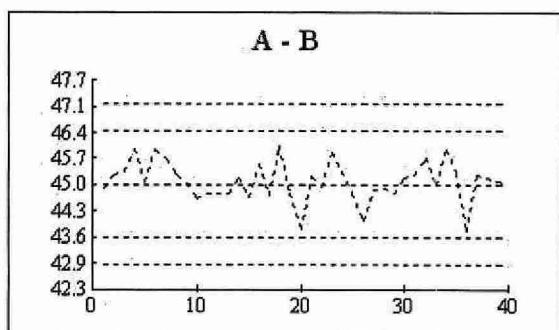
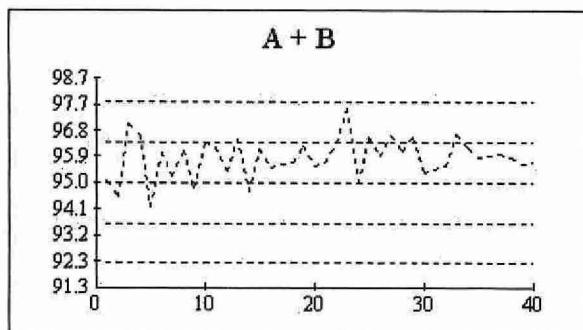
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	96.11	93.59	97.82	92.18
A - B	46.46	43.59	47.11	42.89
B + C	33.43	31.57	34.35	30.65
B - C	18.43	16.52	18.89	16.11

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
74	0 - 10%	0.582	24.5
21	10 - 20%	0.614	4.2
17	20 - 50%	1.299	4.4
1	50 - 100%	N.A.	N.A.
113	Total	0.739	8

Other Checks	Number	Mean	Std. Dev.
LTB	40	-0.413	0.5693

Colour: true (E3219A)
QC Data; 2005/1/1 to 2005/12/31



CONDUCTIVITY

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced:	01/04/74
Method Reference No:	E3218	Reporting Units:	$\mu\text{S}/\text{cm}$ at 25°C
LIMS Product Code:	PHALCO3218, CONDPH3218	Supervisor:	P. Wilson
Sample Type/Matrix:	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

After equilibration at room temperature, the conductivity of the sample is measured. Temperature compensation is applied by the system. Total fixed endpoint alkalinity and pH are determined simultaneously.

INSTRUMENTATION:

Automated modular continual flow conductivity system comprising of a sampler and conductivity meter with cell plus computer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 1	Current T value: 5
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CONTROLS:

Calibration:	LTBL plus 4 standards, e.g. QCA
Drift:	In run standards throughout the run (tap water diluted to 50% V/V)

CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/22/05

Analytical Range: to 2000 $\mu\text{S}/\text{cm}$

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	132	1413	1411.56	-1.4402	3.9478
B:	132	718	717.53	-0.4712	1.8417
C:	132	147	147.42	0.4157	0.5577
D:	132	37.1	37.51	0.4127	0.3514
A+B:		2131	2129.09	-1.9114	4.7363
A-B:		695	694.03	-0.9689	3.9397
B+C:		865	864.94	-0.0555	1.9413
B-C:		571	570.11	-0.8869	1.9071
C+D:		184.1	184.93	0.8284	0.7269
C-D:		109.9	109.90	0.0030	0.5836

s.d.(AB)	S(between runs): 3.08	Sw(within run):	2.79	S/Sw: 1.1
s.d.(BC)	S(between runs): 1.36	Sw(within run):	1.34	S/Sw: 1.0
s.d.(CD)	S(between runs): 0.47	Sw(within run):	0.41	S/Sw: 1.1

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

2109.8	-	2152.2	for A+B
679.1	-	710.9	for A-B
851.9	-	878.1	for B+C
561.2	-	580.8	for B-C
180.04	-	188.16	for C+D
106.86	-	112.94	for C-D

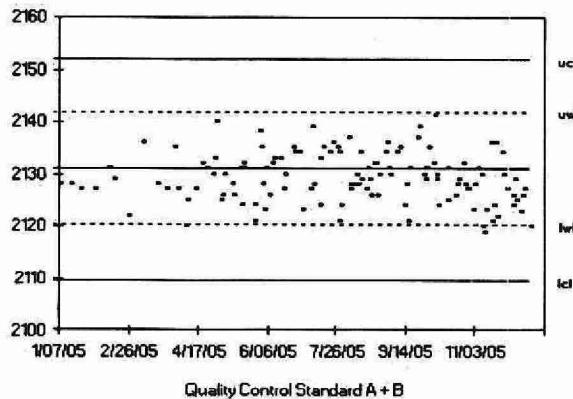
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
95	0 - 200	1.0676	1.0
87	201 - 400	1.8530	0.6
154	401 - 1000	4.5456	0.7
40	1001 - 2000	5.4532	0.4
13	2001 - 10000	8.3205	0.2
389	Overall	3.5413	

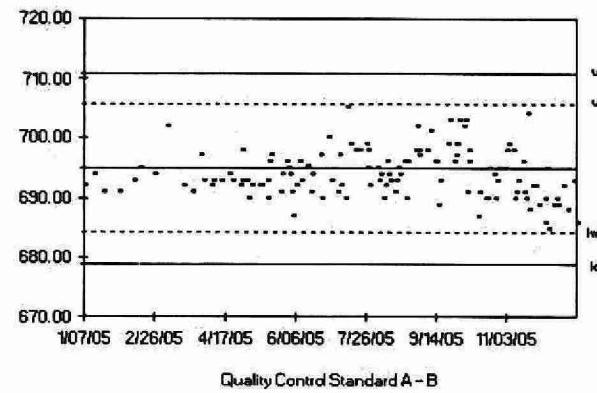
CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/22/05

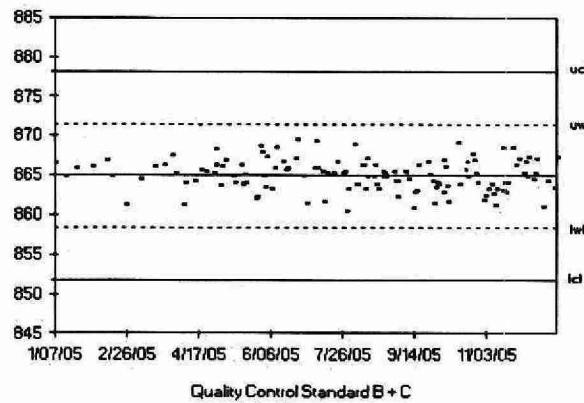
Analytical Range: to 2000 $\mu\text{S}/\text{cm}$



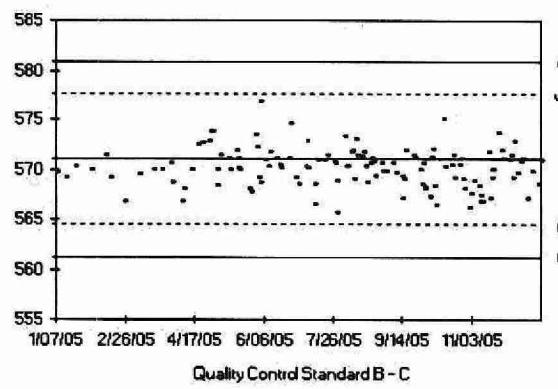
Quality Control Standard A + B



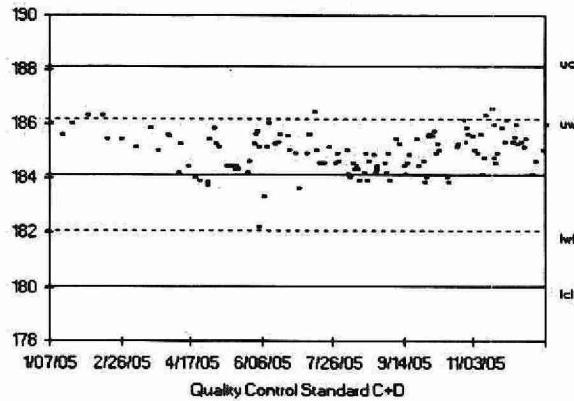
Quality Control Standard A - B



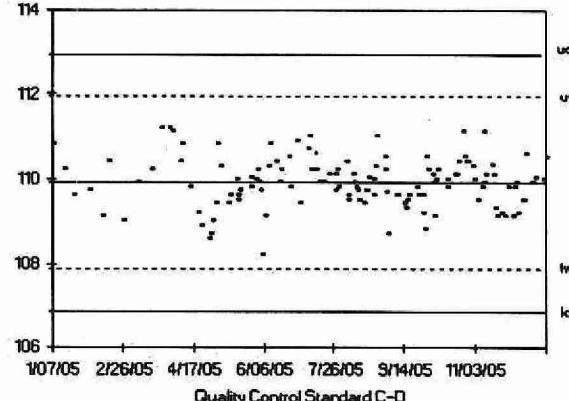
Quality Control Standard B + C



Quality Control Standard B - C



Quality Control Standard C + D



Quality Control Standard C - D

CYANIDE, FREE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN ⁻ Solid: µg/g as CN ⁻
LIMS Product Code	CNF3015	Supervisor	P. Wilson
Sample Type/Matrix	Aqueous: Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. Solid: Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH Solid : 5 g, minimum
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

Free cyanides are the simple and weakly dissociable cyanides which form HCN upon acidification to pH4.0 (such as HCN and KCN). The automated determination of free cyanide exposes the sample to distillation which isolates HCN under specific acidic conditions. A zinc sulphate solution is included which eliminates interference from complexed iron cyanides. Cyanide is determined colourimetrically by the reaction of cyanide with chloramine -T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system by an autosampler. Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours and then centrifuged. The supernatant is decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as µg/g wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600nm.

Skalar data capture and data processing software with computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001 mg/L 0.01 µg/g	Current T value: 0.005mg/L 0.05 µg/g
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CALIBRATION:

BL plus 6 standards (S0 to S5)

NOTE:

December 2002, vegetation matrix removed.

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 02/18/05 TO 12/08/05

Analytical Range: to 0.2 mg/L as CN

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	10	0.15	0.1482	-0.0018	0.0027
B:	10	0.02	0.0192	-0.0008	0.0014
A+B:		0.17	0.1674	-0.0026	0.0027
A-B:		0.13	0.1290	-0.0010	0.0034

s.d.(AB) S(between runs): 0.0022 Sw(within run): 0.0024 S/Sw: 0.90

The calibration is accepted if the calibration control values obtained lie within the ranges:

$$\begin{array}{llll} 0.154 & - & 0.186 & \text{for A+B} \\ 0.118 & - & 0.142 & \text{for A-B} \end{array}$$

REFERENCE MATERIAL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
KCN:	10	0.10	0.1026	0.0026	0.0079
FeCN:*	10	<0.001*	0.0032	0.0032	0.0057

* 2000 to 2005 data

FeCN is not expected to be detected for free cyanide. Results should be <= w or <0.001 although standard tested is 0.10 mg/L.

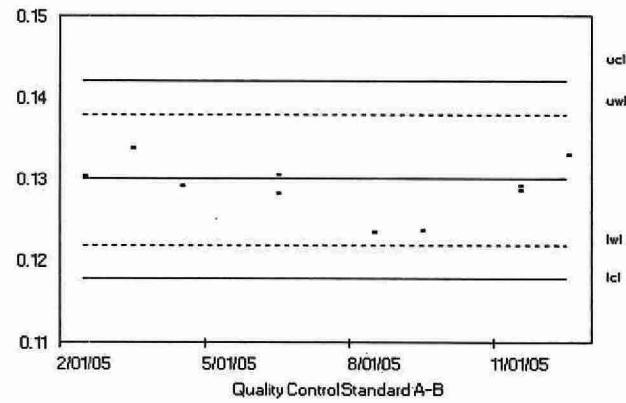
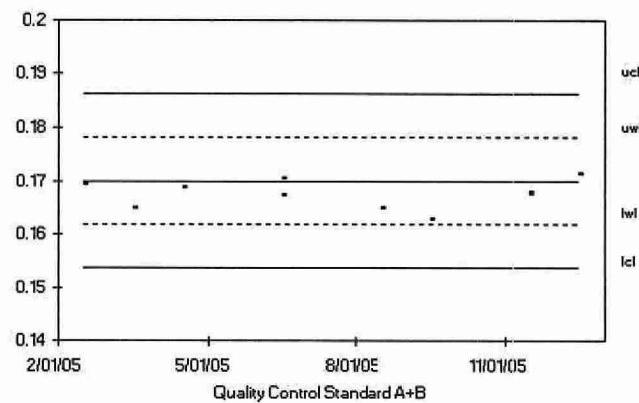
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
20	0 - 0.020	0.0004	16.8
1	0.021 - 0.040	N.A.	N.A.
0	0.041 - 0.100	N.A.	N.A.
2	0.101 - 0.200	N.A.	N.A.
23	Overall	0.0005	

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 02/18/05 TO 12/08/05

Analytical Range: to 0.2 mg/L as CN



CYANIDE, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN ⁻ Solid: µg/g as CN ⁻
LIMS Product Code	CN3015, TCLPCN3015	Supervisor	P. Wilson
Sample Type/Matrix	Aqueous: Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. Solid: Soil, Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH Solid : 5 g, minimum
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

Total cyanides include free, simple (HCN,KCN) and weakly dissociable cyanides ($\text{Ni}(\text{CN})_4$) as well as those complexed cyanides that decompose to form free cyanides that distill out as HCN in an acidic environment. The automated determination of total cyanide exposes the sample to ultraviolet radiation to break down organic metallic and alkali-complexed cyanide compounds to free cyanide. The distillation step isolates HCN under specific acidic conditions. The sequential combination of UV digestion plus distillation yields the measurement of "total cyanide". Cyanide is measured colourimetrically by the reaction of cyanide with chloramine -T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system from an autosampler.

Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours, then centrifuged. The supernatant is then decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as µg/g wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm. Skalar data capture and data processing software with computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001 mg/L 0.01 µg/g	Current T value: 0.005mg/L 0.05 µg/g
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CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

NOTE:

TCLPCN3015, LIMS product code was added on April 2001.

CYANIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 01/26/05 TO 11/29/05

Analytical Range: to 0.2 mg/L as CN for aqueous samples

Analytical Range: to 0.2 µg/g as CN for soil samples

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	29	0.15	0.1472	-0.0028	0.0021
B:	29	0.02	0.0191	-0.0009	0.0016
A+B:		0.17	0.1664	-0.0036	0.0023
A-B:		0.13	0.1281	-0.0019	0.0029

s.d.(AB) S(between runs): 0.0018 Sw(within run): 0.0020 S/Sw: 0.90

The calibration is accepted if the calibration control values obtained lie within the ranges:

$$\begin{array}{lll} 0.154 & - & 0.186 \text{ for A+B} \\ 0.118 & - & 0.142 \text{ for A-B} \end{array}$$

REFERENCE MATERIAL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
KCN:	29	0.10	0.0936	-0.0064	0.0240
FeCN:	29	0.10	0.0913	-0.0087	0.0237
CLP Soil:(0.2)	8	44.70	54.8049	10.1049	6.1192

DUPLICATES:

Aqueous Samples:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation (%)
46	0 - 0.020	0.00055	14.0
4	0.021 - 0.040	0.00062	2.0
4	0.041 - 0.100	0.00107	2.0
7	0.101 - 0.200	0.00296	2.0
61	Overall	0.00116	

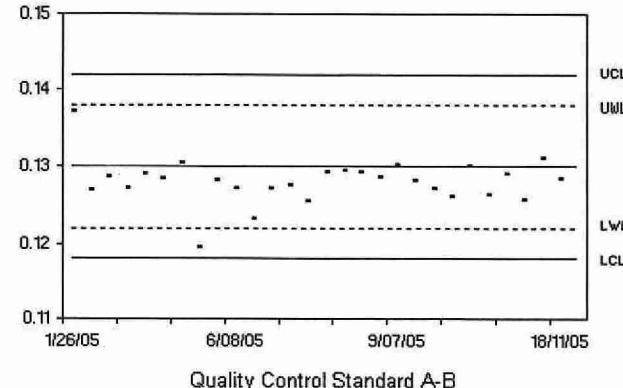
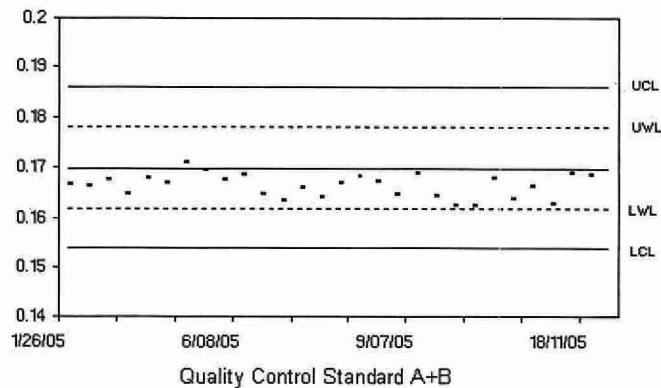
Soil Samples:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation (%)
7	0 - 0.020	0.00058	10.0
0	0.021 - 0.040	N.A.	N.A.
1	0.041 - 0.100	N.A.	N.A.
0	0.101 - 0.200	N.A.	N.A.
8	Overall	0.00054	

CYANIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 01/26/05 TO 11/29/05

Analytical Range: to 0.2 mg/L as CN



FLUORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	October 2001
Method Reference No	E3172	Reporting Unit	mg/L as F
LIMS Product Code	F3172, ANION3172, TCLPF3172	Supervisor	P. WILSON
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Drinking Water, Ground Water, Leachate, Surface Water, Raw Sewage, Sediment, Dried Sludge, Unknown Material, Soil		

SAMPLING:

Quantity Required	50 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Fluoride is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.0010 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detector. The concentration of fluoride in mg/L as F is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for the automated sample introduction , timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTB plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

NOTES:

This method replaced E3369, October 2001.

Method E3369 calibration control values were used to establish initial control limits for the present method. LIMS product code TCLPF3172 was added, October 2001.

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/23/05

Analytical Range: to 2.0 mg/L as F

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	83	1.60	1.61	0.01	0.0133
B:	83	0.80	0.81	0.01	0.0115
C:	83	0.16	0.16	0.00	0.0065
A+B:		2.40	2.42	0.02	0.0191
A-B:		0.80	0.80	0.00	0.0158
B+C:		0.96	0.98	0.02	0.0139
B-C:		0.64	0.65	0.01	0.0125

s.d.(AB) S(between runs):0.0124 Sw(within run): 0.0112 S/Sw: 1.1
 s.d.(BC) S(between runs):0.009 Sw(within run): 0.009 S/Sw: 1.0

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.35	-	2.45	for	A+B
0.762	-	0.838	for	A-B
0.914	-	1.006	for	B+C
0.606	-	0.674	for	B-C

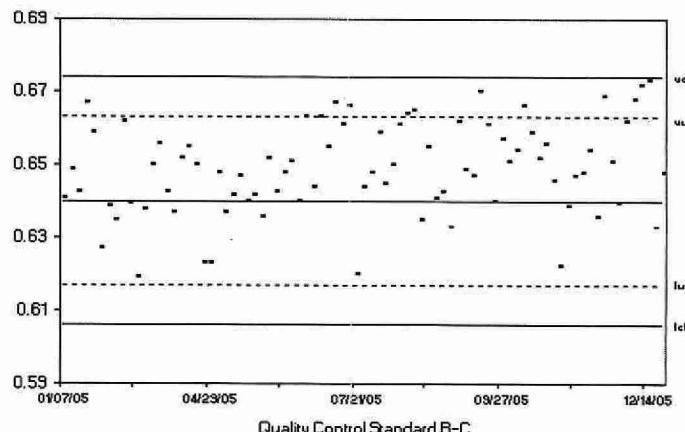
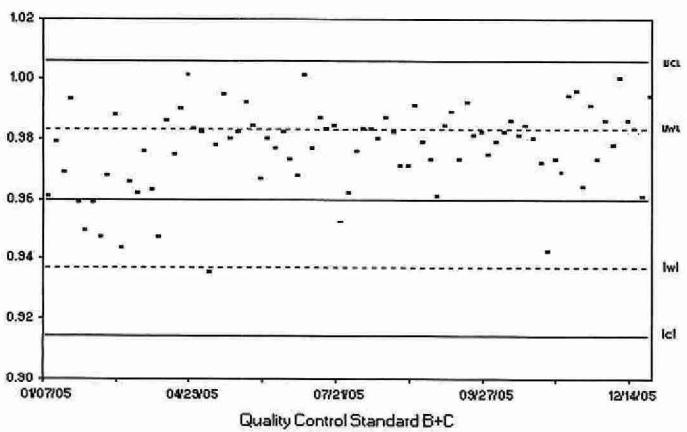
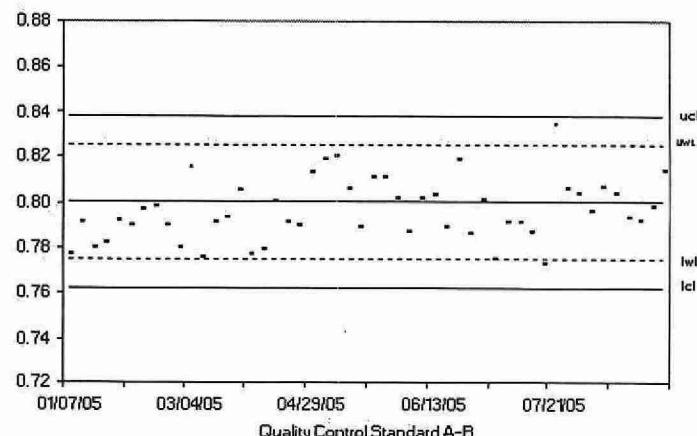
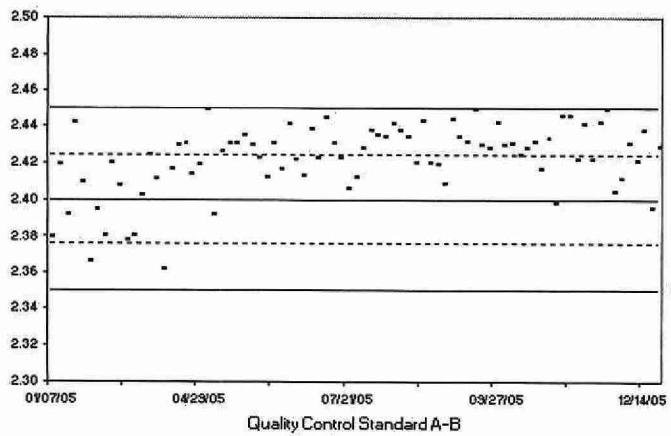
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
141	0.00 - 0.10	0.0055	11.0
23	0.10 - 0.20	0.0079	6.2
24	0.21 - 0.40	0.0093	3.3
35	0.41 - 1.00	0.0120	2.1
9	1.01 - 2.00	0.0087	0.6
232	Overall	0.0077	

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/23/05

Analytical Range: to 2.0 mg/L as F



NITRATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu\text{g}/\text{m}^3$ as NO_3^-
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Nitrate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of nitrate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu\text{g}/\text{m}^3$ as NO_3^- .

Chloride and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1 $\mu\text{g}/\text{m}^3$	Current T value: 0.5 $\mu\text{g}/\text{m}^3$
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CALIBRATION:

9 standards

CONTROLS:

Calibration	MB, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of NO_3 in $\mu\text{g}/\text{m}^3$ is calculated by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

NITRATE (E3004)

QUALITY CONTROL DATA FROM 01/12/04 TO 12/22/05

Analytical Range: to 100 mg/L as NO₃

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	80	80.3297	0.3297	1.0770
B:	47	20	20.0648	0.0648	0.2631
A+B:		100	100.3945	0.3945	1.3190
A-B:		60	60.2650	0.2650	0.8476

s.d.(AB) S(between runs): 0.67 Sw(within run): 0.52 S/Sw: 1.3

The calibration is accepted if the calibration control values obtained lie within the ranges:

98.24 - 101.76 for A+B
58.68 - 61.32 for A-B

In House Control standard data from 01/03/05 to 12/22/05:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
CS4	17	11.97	12.28	0.31	0.3830
CS5	17	16.12	16.29	0.17	0.2693

The standards are accepted if the control values obtained lie within the ranges:

10.61 - 13.33 for CS4
15.66 - 16.72 for CS5

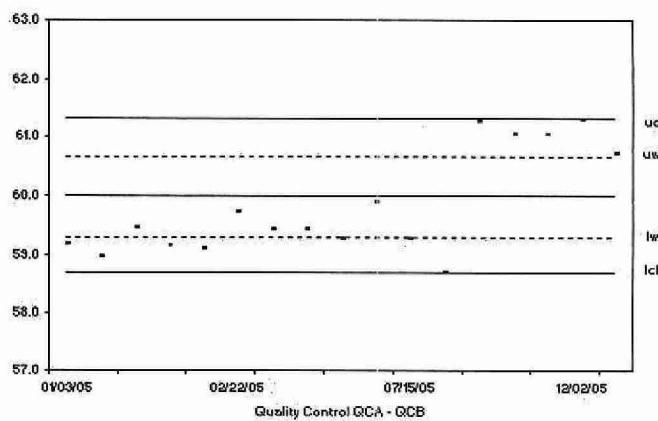
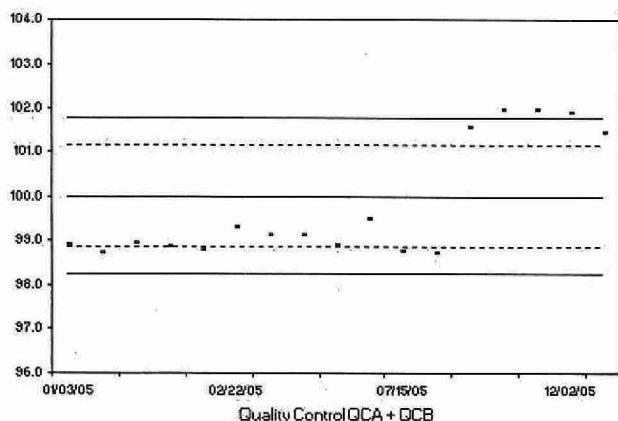
DUPLICATES (from 01/03/05 to 12/22/05):

n Data Pairs	Sample Concentration Span ($\mu\text{g}/\text{m}^3$)	Standard Deviation (2)	Coefficient of variation(%)
39	0.00 - 2.86	0.0444	6.7
6	2.89 - 7.15	0.0765	2.0
3	7.18 - 14.31	0.4065	3.9
1	14.33 - 28.61	N.A.	N.A.
49	Overall	0.2441	

NITRATE (E3004)

QUALITY CONTROL DATA FROM 01/03/05 TO 12/22/05

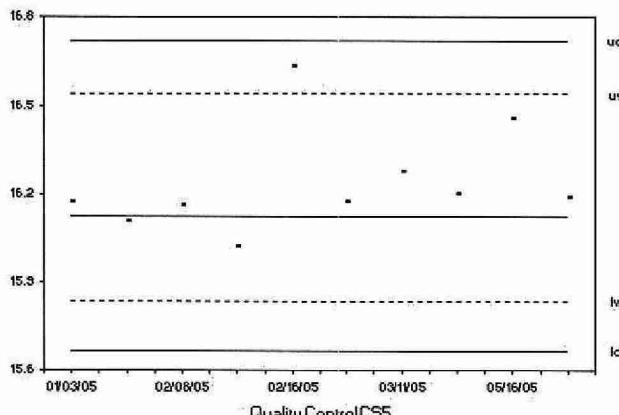
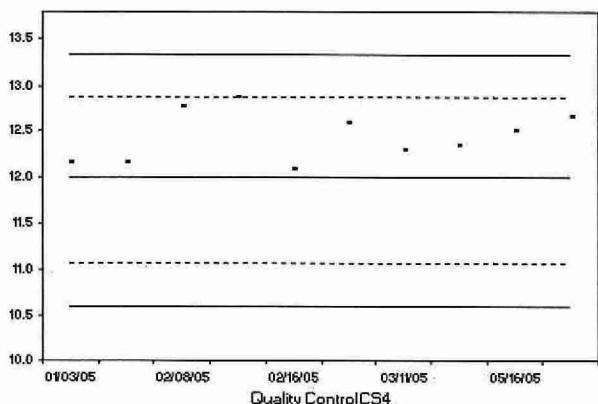
Analytical Range: to 100 mg/L



NITRATE (E3004)

QUALITY CONTROL DATA FROM 01/03/05 TO 12/22/05

Analytical Range For CS Controls: to 28.61 $\mu\text{g}/\text{m}^3$



NITRILOTRIACETIC ACID

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	04/17/98
Method Reference No.	E3406	Reporting Unit	mg/L as NTA
LIMS Product Code	NTA3406, TCLPNTA3406	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water for NTA3406; unknown, dried sludge, sediment, soil and industrial waste for TCLPNTA3406		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrilotriacetic Acid is separated from other anions in the samples by automated suppressed gradient ion chromatography. A sodium hydroxide eluent is used with conductivity detection. The concentration of Nitrilotriacetic acid in mg/L as NTA is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system with gradient flow control module .

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	1 standard every 10 samples
Spike	1 blank plus 3 samples

NOTE:

LIMS product code TCLPNTA3406 was added, April 2001.

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 01/19/05 TO 12/06/05

Analytical Range: to 1.00 mg/L as NTA

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	16	0.80	0.8005	0.0005	0.0067
B:	16	0.20	0.2008	0.0008	0.0043
A+B:		1.00	1.0012	0.0012	0.0093
A-B:		0.60	0.5997	-0.0003	0.0063

s.d.(AB) S(between runs): 0.0047 Sw(within run): 0.0045 S/Sw: 1.06

The calibration is accepted if the calibration control values obtained lie within the ranges:

$$\begin{array}{ccccc} 0.95 & - & 1.05 & \text{for} & A+B \\ 0.56 & - & 0.64 & \text{for} & A-B \end{array}$$

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
3	0.00 - 0.10	0.0042	4.1
3	0.10 - 0.20	0.0026	2.5
3	0.20 - 0.50	0.0030	0.9
0	0.50 - 1.00	N.A.	N.A.
9	Overall	0.0033	

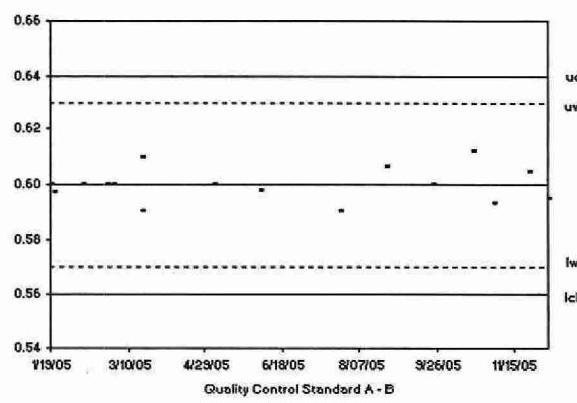
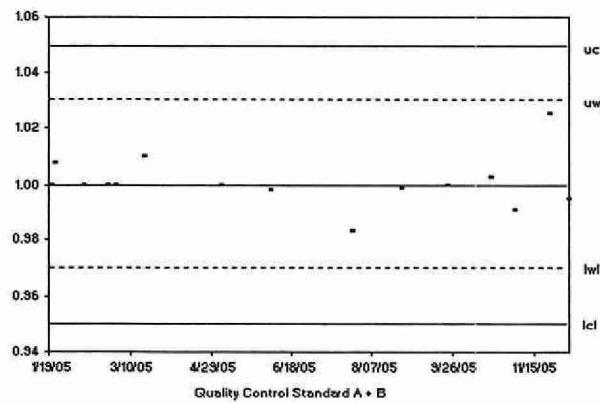
RECOVERY STANDARD:

	n	Expected Concentration (mg/L)	Mean Concentration	Standard Deviation (1)
Spiking Standard	39	0.10	0.1272	0.1554

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 01/19/05 TO 12/06/05

Analytical Range: to 1.00 mg/L as NTA



NITROGEN, AMMONIA PLUS AMMONIUM

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream, which differs from the colour formation stream by replacement of the catalyst with an equal flow of water, is employed to suppress sample matrix effects.

Approximate absorbance: 0.5 at the full scale level.

Nitrate plus nitrite, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus two 38°C heating baths (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm.

Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.002	Current T value: 0.010
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard , and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by "Labtronics" Data Aquisition software in August 1999.

Nitrogen; ammonia+ammonium (E3364)

Analytical Range: to 2 mg/L

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	68	1.6	1.6055	0.0055	0.0089
B	68	0.8	0.8006	0.0006	0.0068
C	68	0.16	0.159	-0.001	0.0055
A + B		2.4	2.4061	0.0061	0.0119
A - B		0.8	0.805	0.005	0.0103
B + C		0.96	0.9596	-0.0004	0.0103
B - C		0.64	0.6415	0.0015	0.0068

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0079
	Within Runs	0.0073
	Between/Within	1.0822
s.d.(BC)	Between Runs	0.0062
	Within Runs	0.0048
	Between/Within	1.2917

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.424	2.376	2.447	2.353
A - B	0.824	0.776	0.835	0.765
B + C	0.974	0.946	0.989	0.933
B - C	0.654	0.626	0.662	0.618

Duplicates

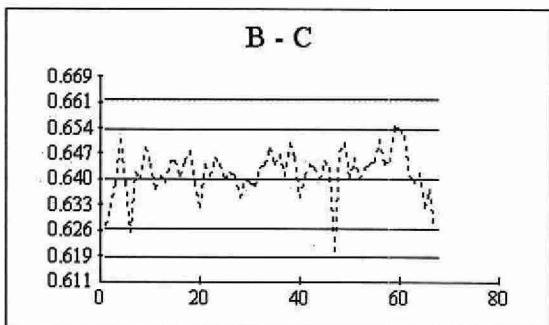
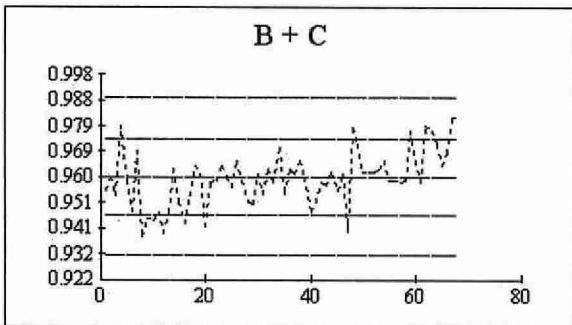
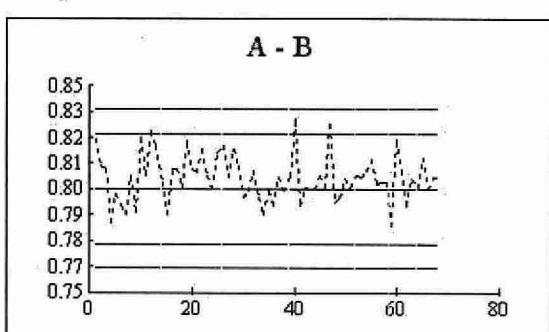
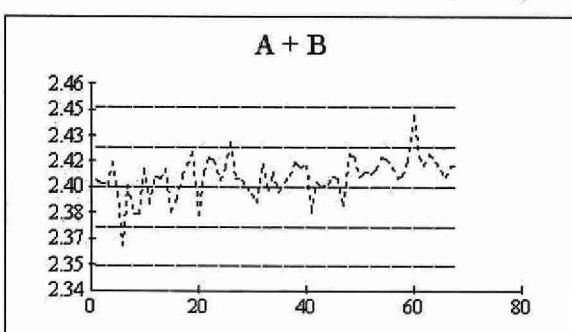
Number	Concentration	Std. Dev.	% Coeff of Var
168	0 - 10%	0.004	24.5
6	10 - 20%	0.009	3.2
4	20 - 50%	0.009	1.1
2	50 - 100%	N/A	N/A
180	Total	0.004	7.3

Other Checks

	Number	Mean	Std. Dev.
LTB	68	0.0043	0.0041

Nitrogen: ammonia+ammonium (E3364A)

QC Data; 2005/1/1 to 2005/12/31



NITROGEN, AMMONIA PLUS AMMONIUM

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/77
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.7 at the full scale level.

Reactive orthophosphate, nitrogen-nitrite and nitrogen-nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus one 38°C heating bath (7.7 mL delay).

Colourimetric measurement is through a 1.5 cm. light path at 630 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in October 1999.

Surface Water matrix was added in October 2005.

Nitrogen; ammonia+ammonium (E3366)

Analytical Range: to 50 mg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	40	40.1128	0.1128	0.2854
B	46	20	20.1913	0.1913	0.1874
C	46	4	3.9983	-0.0017	0.0676
A + B		60	60.3041	0.3041	0.3943
A - B		20	19.9215	-0.0785	0.2787
B + C		24	24.1896	0.1896	0.2214
B - C		16	16.193	0.193	0.1741

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.2414
	Within Runs	0.1971
	Between/Within	1.2248
s.d.(BC)	Between Runs	0.1409
	Within Runs	0.1231
	Between/Within	1.1446

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.62	59.38	61.2	58.76
A - B	20.62	19.38	20.9	19.07
B + C	24.33	23.67	24.7	23.34
B - C	16.33	15.67	16.5	15.5

Duplicates

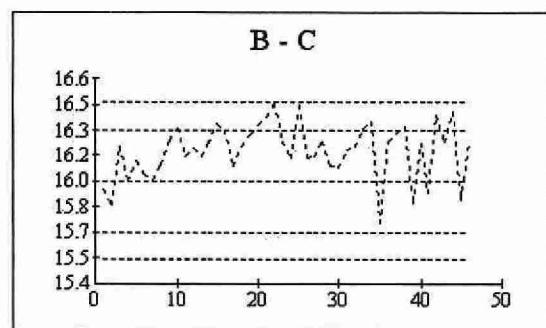
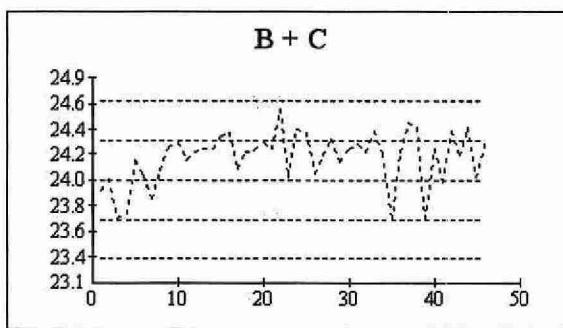
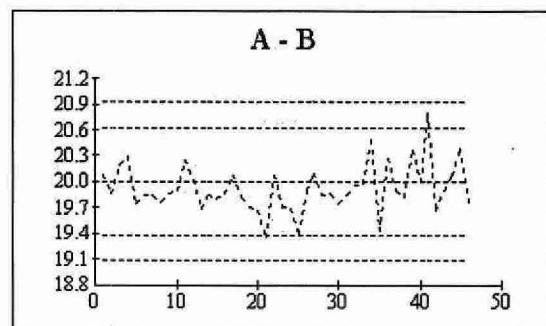
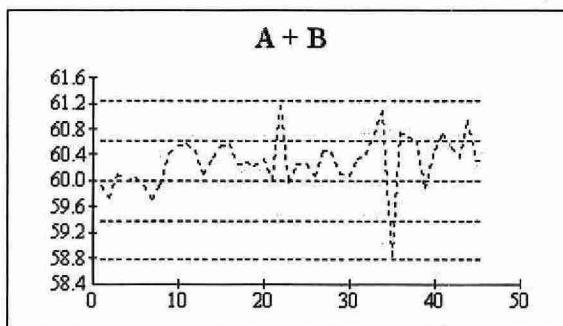
Number	Concentration	Std. Dev.	% Coeff of Var
77	0 - 10%	0.041	9.2
9	10 - 20%	0.098	1.2
30	20 - 50%	0.264	1.4
2	50 - 100%	N/A	N/A
118	Total	0.152	2.4

Other Checks

	Number	Mean	Std. Dev.
LTB	46	-0.0222	0.0271

Nitrogen; ammonia+ammonium (E3366A)

QC Data; 2005/1/1 to 2005/12/31



NITROGEN, NITRATE PLUS NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 37°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.6 at the full scale level.

Ammonia plus ammonium, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay), ion exchange column. Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.005	Current T value: 0.025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES: The HP data capture / processing system was replaced by "Labtronics" Data Aquisition software in August 1999.

Nitrogen; nitrate+nitrite (E3364)

Analytical Range: to 5 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	67	4	4.0056	0.0056	0.034
B	67	2	2.0117	0.0117	0.0181
C	67	0.4	0.3969	-0.0031	0.0098
A + B		6	6.0173	0.0173	0.0463
A - B		2	1.9938	-0.0062	0.0288
B + C		2.4	2.4086	0.0086	0.025
B - C		1.6	1.6148	0.0148	0.0149

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0273
	Within Runs	0.0204
	Between/Within	1.3382
s.d.(BC)	Between Runs	0.0145
	Within Runs	0.0105
	Between/Within	1.381

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	6.066	5.944	6.132	5.868
A - B	2.066	1.934	2.099	1.901
B + C	2.436	2.364	2.472	2.328
B - C	1.636	1.564	1.654	1.546

Duplicates

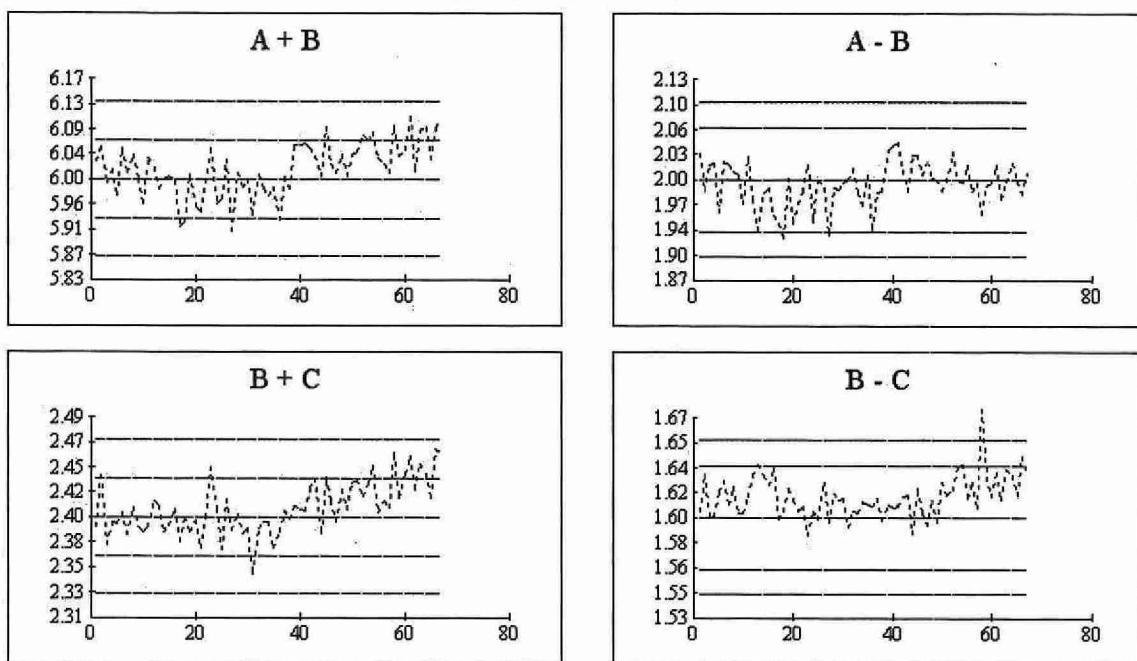
Number	Concentration	Std. Dev.	% Coeff of Var
136	0 - 10%	0.005	2.8
14	10 - 20%	0.011	1.6
19	20 - 50%	0.025	1.4
8	50 - 100%	0.033	1
178	Total	0.012	2

Other Checks

	Number	Mean	Std. Dev.
LTB	67	0.0305	0.2549

Nitrogen; nitrate+nitrite [E3364A]

QC Data: 2005/1/1 to 2005/12/31



NITROGEN, NITRATE PLUS NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366, TCLPNOT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 38°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.7 at the full scale level.

Ammonia plus ammonium, nitrite, and reactive phosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES: The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in October 1999.

LIMS product code TCLPNOT3366 was added in April 2001.

Surface Water matrix was added in October 2005.

Nitrogen; nitrate+nitrite (E3366)

Analytical Range: to 50.0 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	40	40.047	0.047	0.3911
B	46	20	20.1415	0.1415	0.2072
C	46	4	4.0213	0.0213	0.0953
A + B		60	60.1885	0.1885	0.4795
A - B		20	19.9054	-0.0946	0.4022
B + C		24	24.1628	0.1628	0.243
B - C		16	16.1202	0.1202	0.2121

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3129
	Within Runs	0.2844
	Between/Within	1.1002
s.d.(BC)	Between Runs	0.1613
	Within Runs	0.15
	Between/Within	1.0753

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.67	59.33	61.3	58.366
A - B	20.67	19.33	21	18.99
B + C	24.36	23.64	24.7	23.26
B - C	16.36	15.64	16.5	15.46

Duplicates

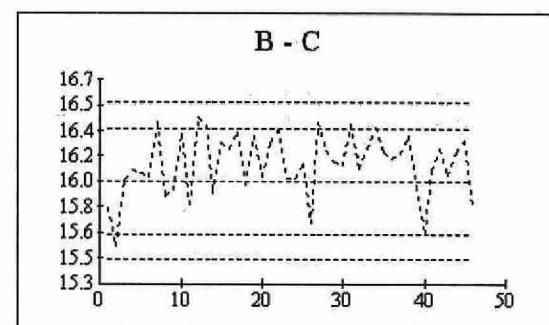
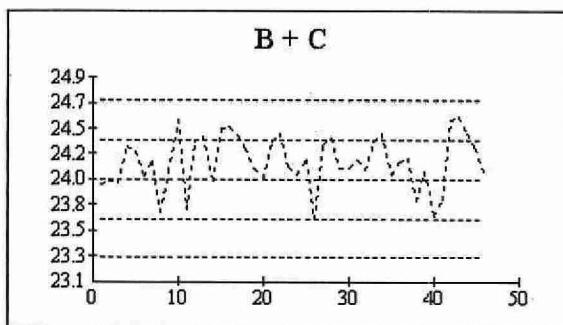
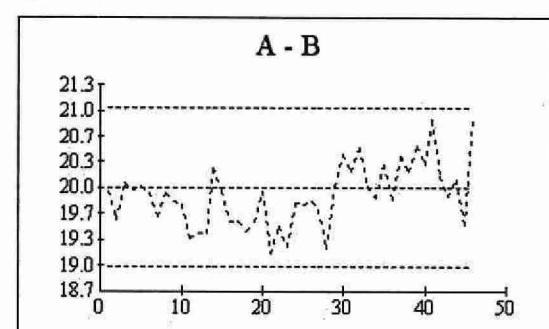
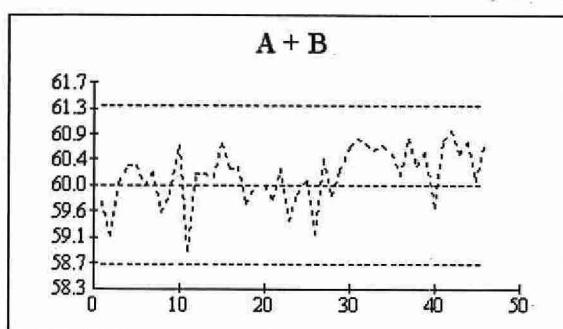
Number	Concentrati on	Std. Dev.	% Coeff of Var
74	0 - 10%	0.037	3.8
24	10 - 20%	0.135	1.8
24	20 - 50%	0.251	1.6
0	50 - 100%	N/A	N/A
122	Total	0.13	2.5

Other Checks

	Number	Mean	Std. Dev.
LTB	46	-0.0143	0.016

Nitrogen; nitrate+nitrite (E3366A)

QC Data; 2005/1/1 to 2005/12/31



NITROGEN, NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride.

Approximate absorbance: 0.6 at the full scale level.

Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm.

Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001	Current T value: 0.005
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL after every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP data capture / processing system was replaced by "Labtronics" Data Aquisition software in August 1999.

Nitrogen; nitrite (E3364)**Analytical Range: to 0.200 mg/L as N****Calibration Control:**

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	67	0.16	0.1602	0.0002	0.0012
B	67	0.08	0.0792	-0.0008	0.0018
C	67	0.016	0.016	0	0.0006
A + B		0.24	0.2394	-0.0006	0.0027
A - B		0.08	0.081	0.001	0.0016
B + C		0.096	0.0952	-0.0008	0.0021
B - C		0.064	0.0632	-0.0008	0.0017

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0016
	Within Runs	0.0011
	Between/Within	1.4545
s.d.(BC)	Between Runs	0.0014
	Within Runs	0.0012
	Between/Within	1.1667

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.243	0.237	0.247	0.235
A - B	0.083	0.077	0.084	0.076
B + C	0.098	0.094	0.100	0.092
B - C	0.066	0.062	0.067	0.061

Duplicates

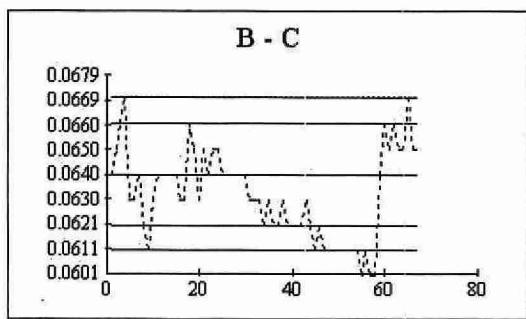
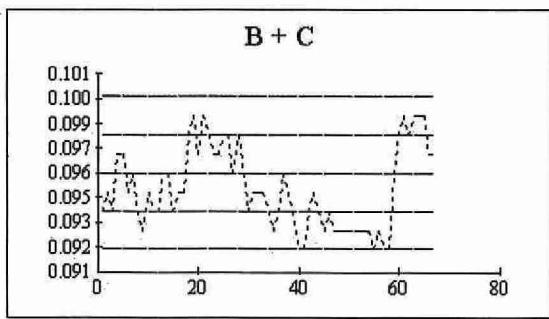
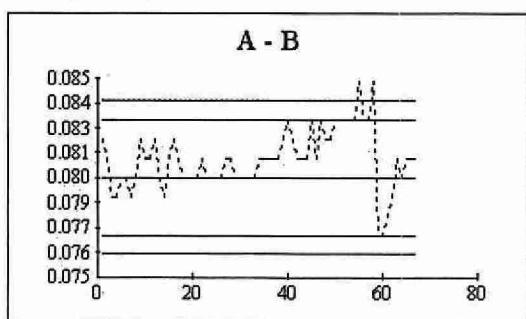
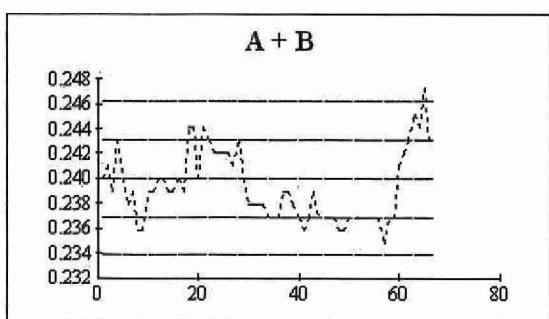
Number	Concentration	Std. Dev.	% Coeff of Var
134	0 - 10%	0.001	28.4
6	10 - 20%	0.001	3.7
6	20 - 50%	0.001	1.7
2	50 - 100%	N/A	N/A
148	Total	0.001	11.8

Other Checks

	Number	Mean	Std. Dev.
LTB	67	0.0005	0.0006

Nitrogen; nitrite [E3364A]

QC Data: 2005/1/1 to 2005/12/31



NITROGEN, NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride.

Approximate absorbance: 0.3 at the full scale level.

Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.005	Current T value: 0.025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in October 1999. Surface Water Matrix was added in October 2005.

Nitrogen; nitrite (E3366)**Analytical Range: to 2.00 as N****Calibration Control:**

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	1.6	1.6067	0.0067	0.0156
B	46	0.8	0.8035	0.0035	0.0087
C	46	0.16	0.1583	-0.0017	0.0045
A + B		2.4	2.4102	0.0102	0.0229
A - B		0.8	0.8031	0.0031	0.0109
B + C		0.96	0.9619	0.0019	0.0118
B - C		0.64	0.6452	0.0052	0.0073

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0127
	Within Runs	0.0077
	Between/Within	1.6494
s.d.(BC)	Between Runs	0.0069
	Within Runs	0.0052
	Between/Within	1.3269

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.424	2.376	2.448	2.353
A - B	0.824	0.776	0.836	0.764
B + C	0.972	0.948	0.984	0.936
B - C	0.652	0.628	0.658	0.622

Duplicates

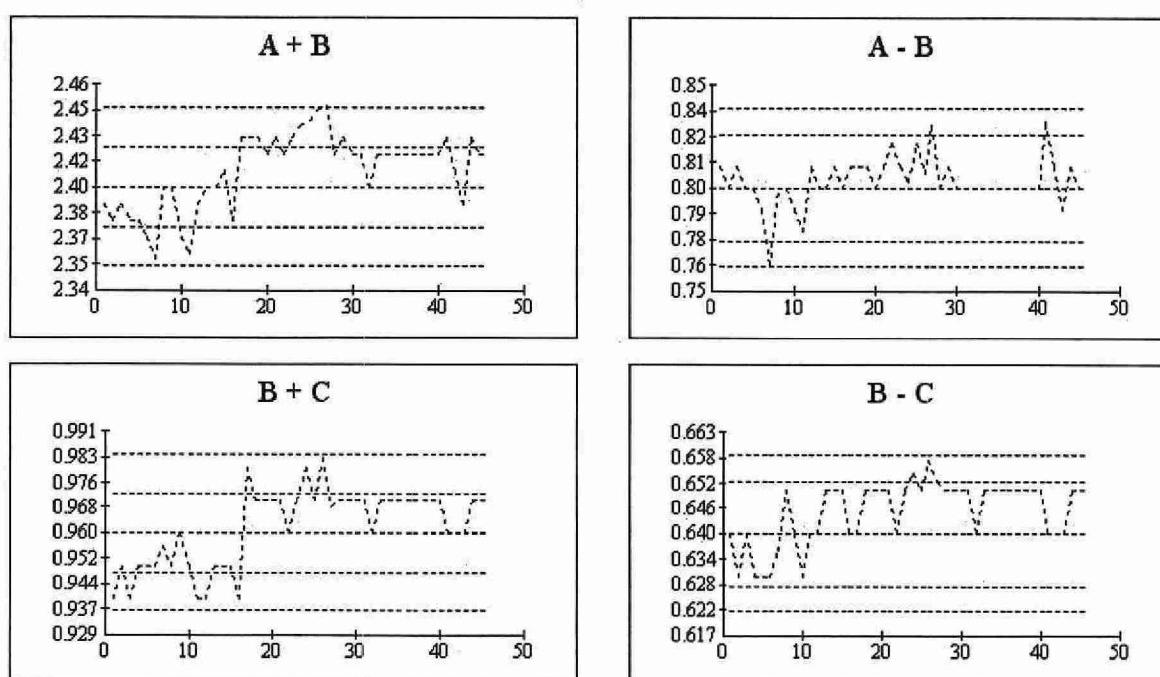
Number	Concentration	Std. Dev.	% Coeff of Var
76	0 - 10%	0.014	26.6
7	10 - 20%	0.003	0.9
10	20 - 50%	0.01	1.3
3	50 - 100%	0.006	0.4
96	Total	0.013	6.8

Other Checks

	Number	Mean	Std. Dev.
LTB	46	0	0

Nitrogen; nitrite (E3366A)

QC Data: 2005/1/1 to 2005/12/31



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as N
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge and Vegetation		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrogen compounds are converted to ammonia/ammonium by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system. Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Hot plate .

Basic automated modular continuous flow system : 37.5°C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.

Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1	Current T value: 0.5
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Drift	Run 80% calibration standard every 10 samples
Recovery	3 digested BL's plus 4 digested standards R1, R2, R3 and R4

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC were implemented in April 2003. February 2004, Method E3118 was amalgamated with E3116. Data capture/processing is done by the "Labtronics" Data Aquisition software.

Nitrogen; total Kjeldahl (E3116)

Analytical Range: to 20 mg/g as N

CALIBRATION CONTROL: (mg/L as N)

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	17	8	8.08	0.08	0.061
B	17	4	4.001	0.001	0.036
C	17	1	0.974	-0.026	0.012
A + B		12	12.081	0.081	0.084
A - B		4	4.079	0.079	0.055
B + C		5	4.975	-0.025	0.038
B - C		3	3.026	0.026	0.038

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0501
	Within Runs	0.0389
	Between/Within	1.2879
s.d.(BC)	Between Runs	0.0268
	Within Runs	0.0269
	Between/Within	0.9963

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.11	11.89	12.22	11.78
A - B	4.11	3.89	4.16	3.84
B + C	5.08	4.92	5.16	4.84
B - C	3.08	2.92	3.12	2.88

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
20	0 - 10%	0.033	6
16	10 - 20%	0.09	5.9
11	20 - 50%	0.223	7.4
4	50 - 100%	0.205	2.7
51	Total	0.13	6.7

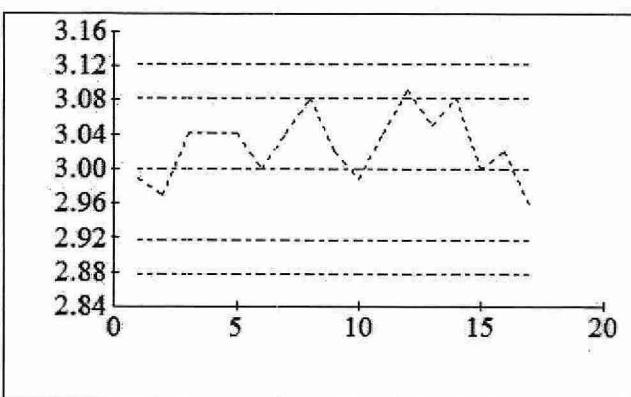
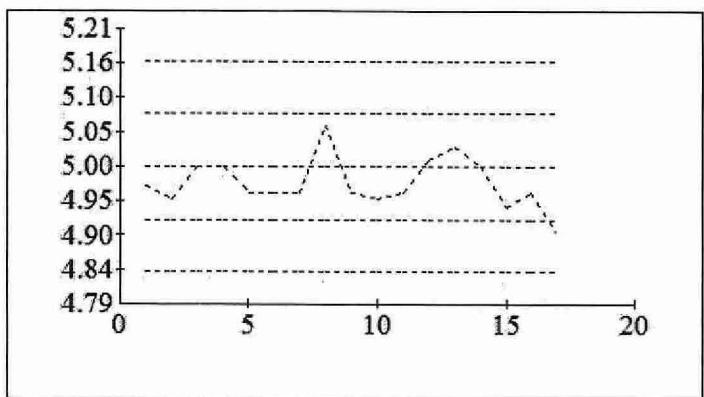
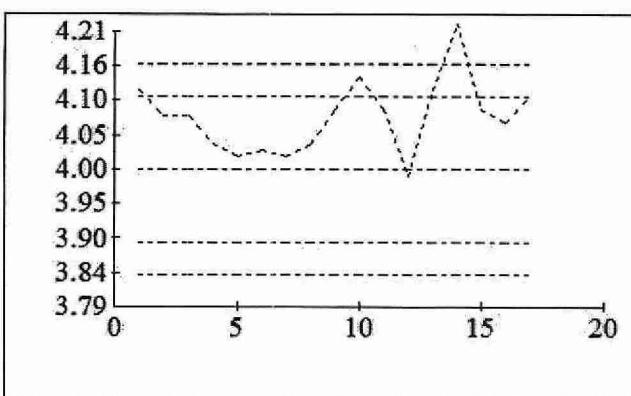
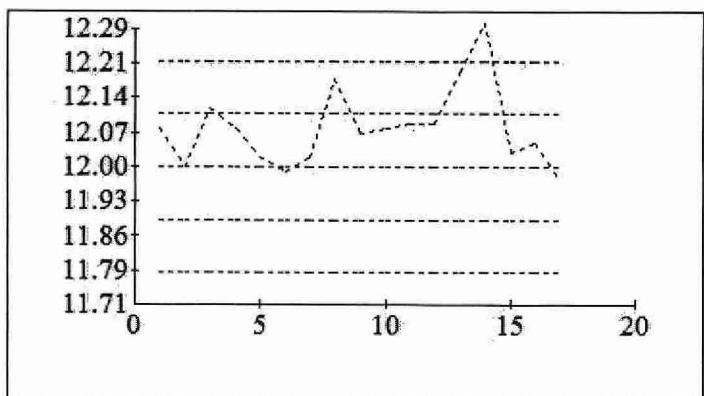
Recoveries

Number	Expected	Mean	Std. Dev.
17	5.25	5.269	0.206
17	1.69	1.477	0.111
17	42.2	41.684	2.542

Other Checks	Number	Mean	Std. Dev.
LTB	17	0.016	0.035
Digested Blank	17	0.070	0.038

Nitrogen; total Kjeldahl (E3116)

QC Data: 2005/1/1 to 2005/12/31



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3367	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.3 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 5.0 cm. light path at 630 nm.

Data capture and processing is via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL, undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in May 1999.

Nitrogen;total Kjeldahl (E3367)

Analytical Range: to 10 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	57	1.6	1.6	0	0.012
B	57	0.8	0.804	0.004	0.007
C	57	0.16	0.161	0.001	0.01
A + B		2.4	2.403	0.003	0.017
A - B		0.8	0.796	-0.004	0.011
B + C		0.96	0.965	0.005	0.014
B - C		0.64	0.642	0.002	0.009

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.01
	Within Runs	0.0078
	Between/Within	1.2821
s.d.(BC)	Between Runs	0.0085
	Within Runs	0.0064
	Between/Within	1.3281

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.44	2.376	2.48	2.32
A - B	0.84	0.76	0.86	0.74
B + C	0.984	0.936	1.007	0.913
B - C	0.663	0.617	0.675	0.605

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
58	0 - 10%	0.019	14.3
60	10 - 20%	0.024	8.4
45	20 - 50%	0.03	5.2
4	50 - 100%	0.034	2.6
167	Total	0.024	7.2

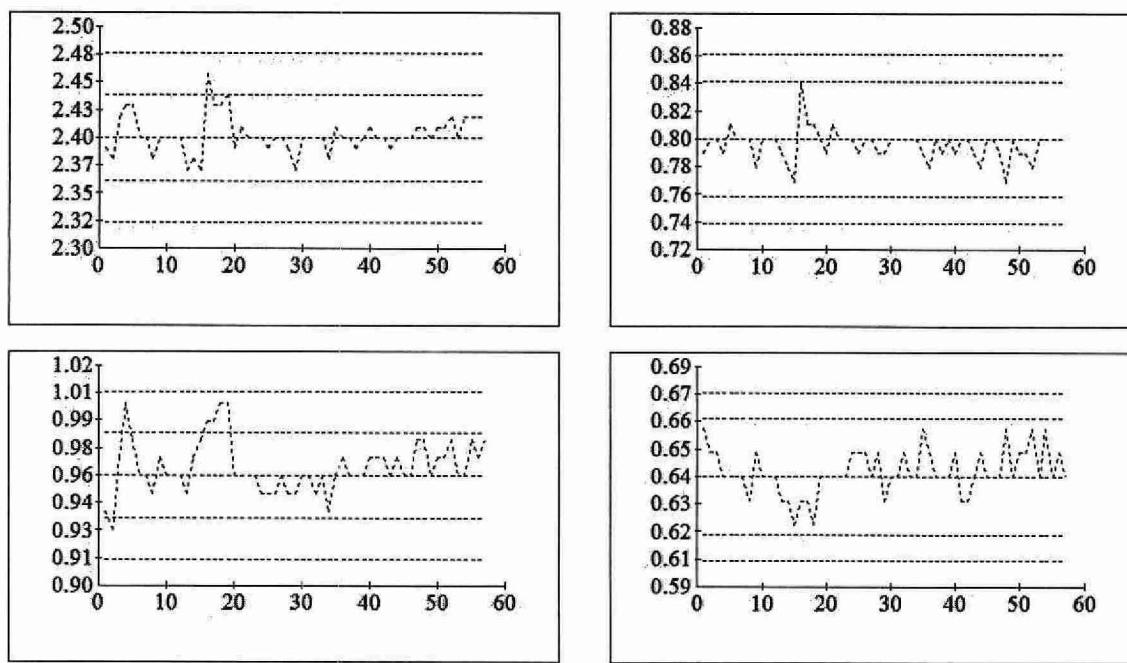
Recoveries			
Number	Expected	Mean	Std. Dev.
57	1.4	1.411	0.032
57	0.84	0.846	0.022
57	0.28	0.285	0.011

Other Checks

	Number	Mean	Std. Dev.
LTB	57	0.002	0.008

Nitrogen:total Kjeldahl (E3367A)

QC Data: 2005/1/1 to 2005/12/31



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3368	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate, Precipitation and Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 1.0 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm.

Data capture and processing is via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL, undigested standard, BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in April 1999. Precipitation and Surface Water were added in October 2005.

Nitrogen; total Kjeldahl (E3368)

Analytical Range: to 50.0 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	42	40	39.93	-0.07	0.23
B	42	20	20.11	0.11	0.103
C	42	4	3.98	-0.02	0.073
A + B		60	60.04	0.04	0.304
A - B		20	19.82	-0.18	0.188
B + C		24	24.091	0.091	0.136
B - C		16	16.13	0.13	0.116

Between Run VS Within Run Standard

Deviations

s.d.(AB)	Between Runs	0.1786
	Within Runs	0.1329
	Between/Within	1.3439
s.d.(BC)	Between Runs	0.0895
	Within Runs	0.082
	Between/Within	1.0915

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.36	59.64	60.73	59.27
A - B	20.36	19.64	20.55	19.45
B + C	24.21	23.79	24.42	23.58
B - C	16.21	15.79	16.32	15.68

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
96	0 - 10%	0.131	15.4
12	10 - 20%	0.241	3.1
9	20 - 50%	0.357	2.4
4	50 - 100%	0.351	1.1
121	Total	0.182	5

Recoveries

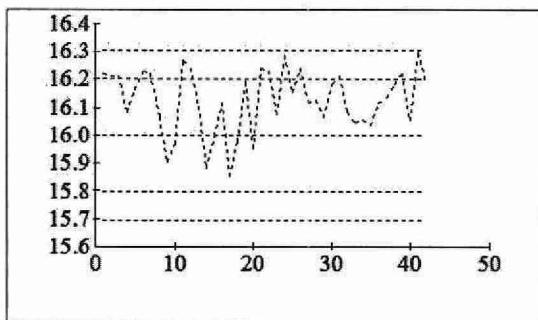
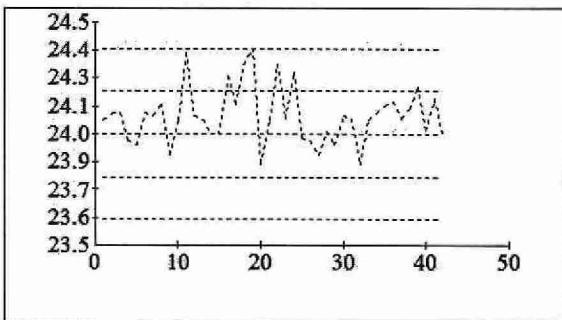
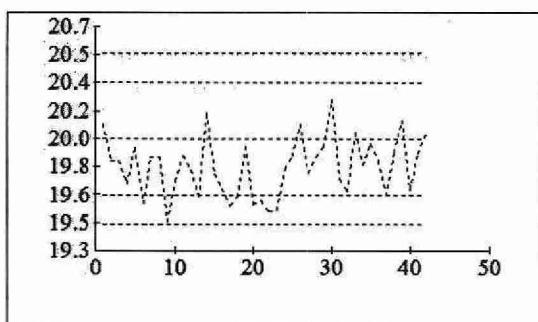
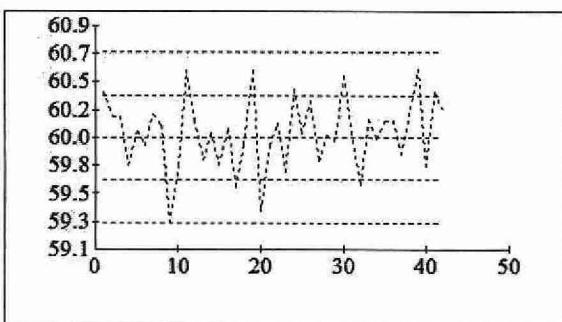
Number	Expected	Mean	Std. Dev.
42	35	34.984	0.495
42	21	21.157	0.347
42	7	7.002	0.105

Other Checks

	Number	Mean	Std. Dev.
LTB	42	-0.064	0.071
Digested Blank	42	-0.071	0.062

Nitrogen: total Kjeldahl (E3368A)

QC Data: 2005/1/1 to 2005/12/31



OXYGEN DEMAND, BIOCHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3182	Reporting Unit	mg/L as O ₂
LIMS Product Code	BOD3182, BODC3182	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Effluent, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	400 mL
Container:	Glass or plastic

SAMPLE PREPARATION:

If necessary sample pH is adjusted to neutral and chlorine is removed by reaction with sodium sulphite.

ANALYTICAL PROCEDURE:

Oxygen depletion is measured as the difference in dissolved oxygen (DO) concentration. DO readings are taken prior to sample storage, and also at the end of storage in the dark at 20°C for five days (BOD₅). If necessary, dilutions are made with aerated, nutrient-enriched water to obtain a 25-75% oxygen depletion. If the sample has undergone any of the sample preparation steps listed above or if the sample is an industrial waste, a sewage seed is added. For such samples, calculation of an appropriate seed correction is required.

INSTRUMENTATION:

- YSI Model 59 DO meter (Yellow Springs Instrument Company) with DO probe equipped with stirrer and fitted with a Teflon membrane of 0.5 mil thickness which is permeable to oxygen (1 mil = 0.001 inch).
- Titration equipment for Winkler analysis of dissolved oxygen.
- Incubator (19-21°C); BOD bottles (300 mL)

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION (DO):

The standard is air-saturated reverse osmosis deionized water. The DO content is read from a table (ORBISPHERE LABORATORIES - Pressure/temperature/dissolved oxygen table) after measuring the temperature and the barometric pressure in the laboratory.

OXYGEN DEMAND, BIOCHEMICAL cont'd

CONTROLS:

Calibration (DO)	2 QC solutions of Pure-DW water which have been partially stripped of DO by flushing with nitrogen. These "solutions", of different but unknown DO, are compared using the oxygen meter and the Winkler titration procedure. The difference between the values for the two analytical methods is utilized as a slope control for the DO Analyzer.
Recovery (BOD5)*	3 Recovery standards prepared from a combination of Glucose and Glutamic Acid e.g. R1; the expected BOD5 is 67% of the oxygen requirement for complete oxidation.
Drift	Air saturated Pure-DW water after every 24 samples.
Blanks*	Pure-DW water and BOD dilution water

NOTES:

* These solutions are incubated for five days alongside samples.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/28/05

Analytical Range: to 9.0 mg/L as O₂ at 20°C

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	125	0.00	0.0251	0.0251	0.0914
B:	125	0.00	0.0628	0.0628	0.0674

On any given day the calibration is accepted if the values obtained lie within the ranges:

-0.25 - 0.25

RECOVERIES:

Number of Data	Expected Depletion	Mean Depletion	Standard Deviation (1)
64	2.17	2.16	0.1673
64	4.34	4.35	0.2463
64	6.54	6.55	0.2817

DUPLICATES:

For BOD:

n Data Pairs	Sample Depletion Span	Standard Deviation (2)	Coefficient of variation(%)
22	0.0 - 1.8	0.1395	15.3
15	1.9 - 4.5	0.0982	3.3
3	4.6 - 9.0	0.1711	2.4
40	Overall	0.1285	

For BODC:

n Data Pairs	Sample Depletion Span	Standard Deviation (2)	Coefficient of variation(%)
48	0.0 - 1.8	0.1031	11.1
65	1.9 - 4.5	0.1352	4.6
39	4.6 - 9.0	0.1943	2.9
152	Overall	0.1444	

OTHER CHECKS:

	n	Mean	Standard Deviation (1)
5 Day Pure-DW Blank	65	0.0428	0.1295
5 Day BOD Blank	65	0.0463	0.1195

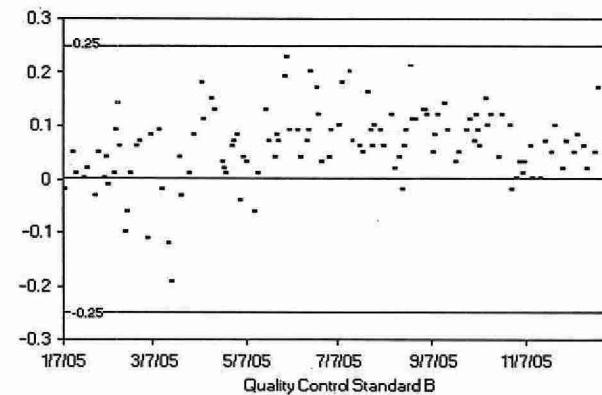
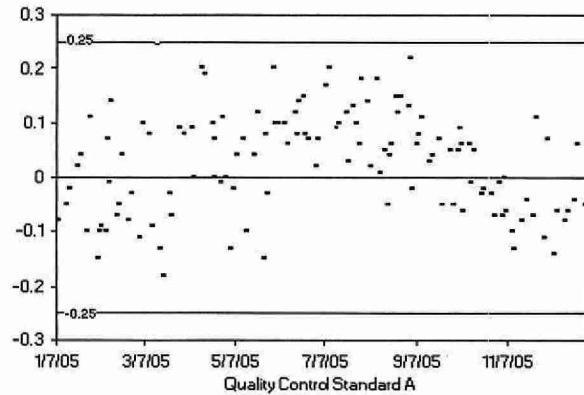
NOTES:

The final concentration of BOD in mg/L as O₂ is determined by the oxygen depletion after 5 days at 20°C multiplied by a dilution and seed correction factor.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/28/05

Analytical Range: to 9.0 mg/L as O₂ at 20°C



OXYGEN DEMAND, CHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3170	Reporting Unit	mg/L as O ₂
LIMS Product Code	COD3170	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	25 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium.

Approximate absorbance: 0.05 at the full scale level.

INSTRUMENTATION:

- Culture tubes with Teflon caps, mechanical-convection oven
- Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 1	Current T value: 5
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CALIBRATION:

3 digested BL plus 3 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Digested BL, standard, and digested BL every 10 samples
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (40 mg/L as O ₂) spiked with 50 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand Chemical (E3170)

Analytical Range: to 50 as O₂

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	25	40	39.9016	-0.0984	1.2793
B	25	10	10.2516	0.2516	1.1029
A + B		50	50.1532	0.1532	1.9896
A - B		30	29.65	-0.35	1.322

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.1944
	Within Runs	0.9348
	Between/Within	1.2777

CONTROL LIMITS:

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	52.0	48.0	53.7	46.3
A - B	32.0	28.0	32.8	27.2

DUPLICATES:

Number	Concentration	Std. Dev.	% Coeff of Var
11	0 - 10%	1.254	77.7
12	10 - 20%	0.853	11.2
24	20 - 50%	2.176	12.1
14	50 - 100%	1.562	4.5
61	Total	1.688	10.1

RECOVERIES:

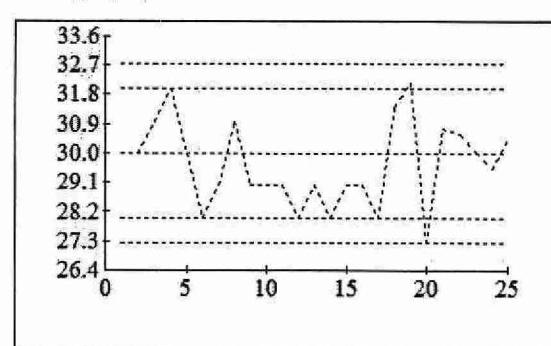
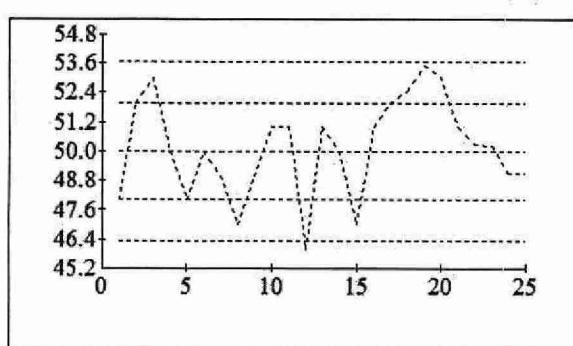
Number	Expected	Mean	Std. Dev.
50	40	38.5294	2.3514
50	10	9.2647	1.5434

OTHER CHECKS:

	n	Expected	Mean	Std. Dev.
Chloride Check	25	40	38.278	1.8747

Oxygen Demand Chemical (E3170)

QC Data: 2005/1/1 to 2005/12/31



OXYGEN DEMAND, CHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3246	Reporting Unit	mg/L as O ₂
LIMS Product Code	COD3246	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Ground Water, Leachate, Effluent, Sludge, Surface Water, Process Water		

SAMPLING:

Quantity Required	25 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.6 at the full scale level.

INSTRUMENTATION:

-Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2	Current T value: 10
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CALIBRATION:

2 digested BL plus 4 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Digested BL, Standard and Digested BL every 10 samples
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (50 mg/L as O ₂) spiked with 900 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand Chemical (E3246)

Analytical Range: to 400 mg/L as O₂

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	88	400	398.7669	-1.2331	6.7973
B	88	100	98.316	-1.684	4.8757
A + B		500	497.083	-2.917	9.0241
A - B		300	300.4509	0.4509	7.6496

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	5.9151
	Within Runs	5.4091
	Between/Within	1.0935

CONTROL LIMITS:

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	510	490	522.5	477.5
A - B	310	290	315	285

DUPLICATES:

Number	Concentration	Std. Dev.	% Coeff of Var
78	0 - 10%	3.927	17.9
73	10 - 20%	3.99	6.9
67	20 - 50%	5.539	4.1
31	50 - 100%	9.547	3.6
253	Total	5.374	5.4

RECOVERIES:

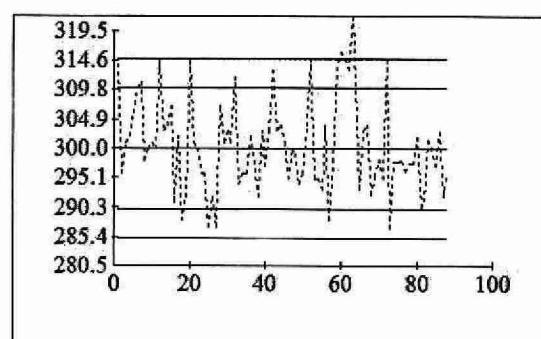
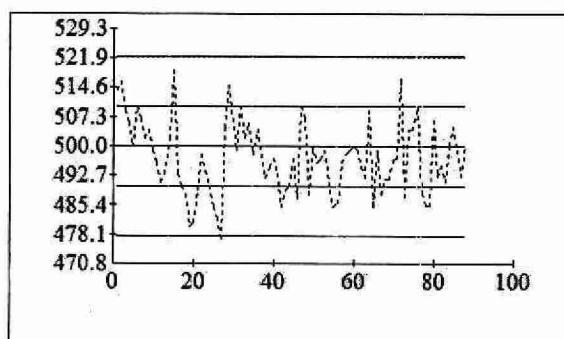
Number	Expected	Mean	Std. Dev.
176	400	391.115	10.64
176	100	96.36	7.47

OTHER CHECKS:

	n	Expected	Mean	Std. Dev.
Chloride Check	88	50	39.5	12.45

Oxygen Demand Chemical (E3246)

QC Data: 2005/1/1 to 2005/12/31



pH

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No	E3218	Reporting Units	Dimensionless
LIMS Product Code	PHALCO3218, CONDPH3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

pH is directly measured on a stirred sample (20.0 mL) at room temperature. Stirring rate, tube size, degree of electrode immersion, and room temperature range are uniform for all samples and standards. Total fixed endpoint alkalinity, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Maximum Significant Figures: 3

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9

CONTROLS:

Calibration	2 QC standards e.g. QCA
Drift	In-run standards throughout the run (diluted tap water 50% V/V)

pH (E3218)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/22/05

Analytical Range: to 14.00 Dimensionless

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	132	7.41	7.40	-0.01	0.0142
B:	132	4.45	4.45	0.00	0.0395
A+B:		11.86	11.85	-0.01	0.0424
A-B:		2.96	2.95	-0.01	0.0415

s.d.(AB) S(between runs): 0.021 Sw(within run): 0.021 S/Sw: 1.01

On any given day the calibration is accepted if the values obtained lie within the ranges:

11.64 - 12.08 for A+B
2.79 - 3.13 for A-B

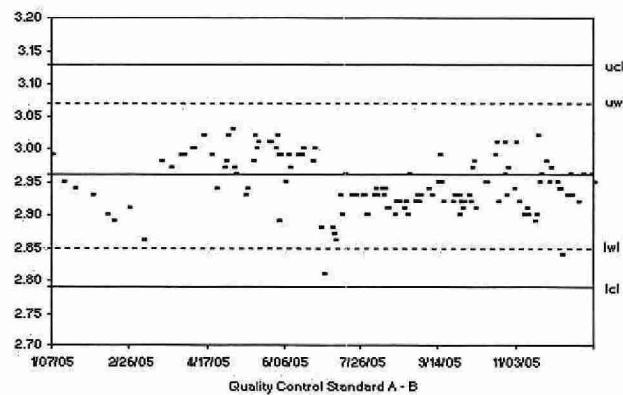
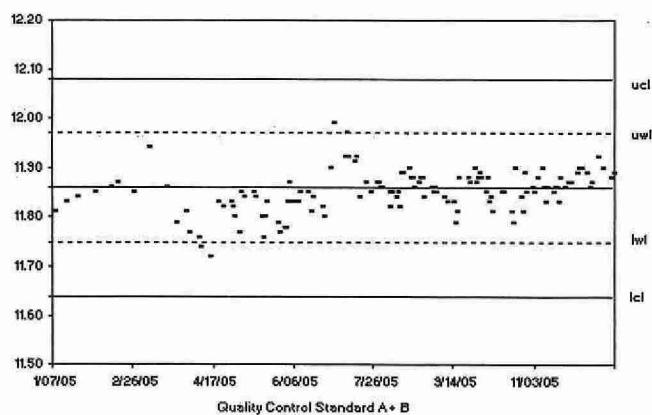
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
42	1.00 - 7.00	0.0636	1.0
165	7.01 - 8.00	0.0550	0.7
182	8.01 - 12.00	0.0557	0.7
389	Overall	0.0823	

pH (E3218)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/22/05

Analytical Range: to 14.00 Dimensionless



PHENOLICS, REACTIVE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/74
Method Reference No.	E3179	Reporting Unit	µg/L as Phenol
LIMS Product Code	PHEN3179	Supervisor	P.Wilson
Sample Type/Matrix	Ground Water, Surface Water, Effluent, Drinking Water, Leachate, Raw Sewage, Industrial Waste, Process Water, Precipitation		

SAMPLING:

Quantity Required	250 mL
Container	Glass, (Phenol bottle with white cap containing preservative is available)
Preservative	Sulfuric acid to pH 1.5 - 2

ANALYTICAL PROCEDURE:

Samples are automatically distilled from an acid media, and reactive phenolics in the distillate are determined colourimetrically by formation of an antipyrene dye through reactions with 4-aminoantipyrene and potassium ferricyanide.

Approximate absorbance: 0.03 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system plus a distillation module. Colourimetric measurement is through a 5.0 cm. light path at 505 nm. Data capture and processing via a Data Aquisition System.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA (see note)
Drift	BL ,standard ,BL every 10 samples

NOTES:

An additional Quality Control Standard (QCC) was added to the method in March 1997.

The HP data capture / processing system was replaced by "Labtronics" Data Aquisition software in August 2002.

Phenolics; 4-AAP (E3179)

Analytical Range: to 50.0 ug/L as Phenol

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	37	40	39.295	-0.705	0.455
B	37	10	10.089	0.089	0.257
C	37	5	5.116	0.116	0.199
A + B		50	49.384	-0.616	0.599
A - B		30	29.205	-0.795	0.431
B + C		15	15.205	0.205	0.397
B - C		5	4.973	-0.027	0.232

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3692
	Within Runs	0.3048
	Between/Within	1.2113
s.d.(BC)	Between Runs	0.2299
	Within Runs	0.164
	Between/Within	1.4018

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	50.965	49.035	51.93	48.07
A - B	30.965	29.035	31.448	28.552
B + C	15.464	14.536	15.928	14.072
B - C	5.464	4.536	5.696	4.304

Duplicates

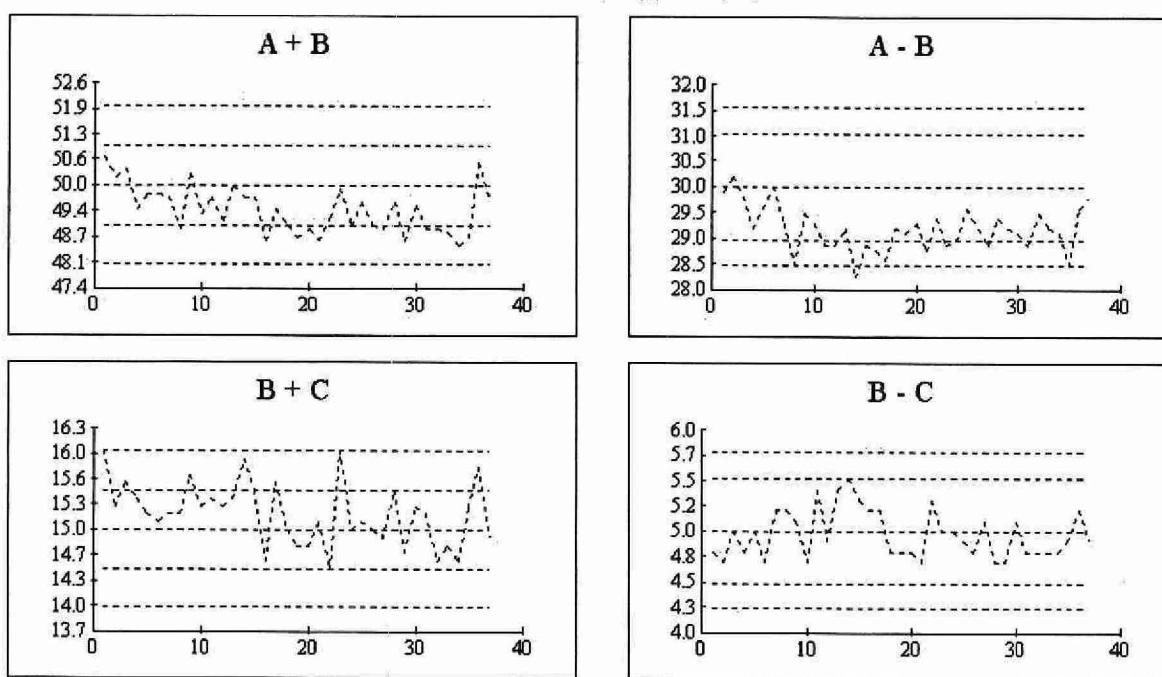
Number	Concentration	Std. Dev.	% Coeff of Var
89	0 - 10%	0.155	39.3
8	10 - 20%	0.283	4.6
1	20 - 50%	N/A	N/A
0	50 - 100%	N/A	N/A
99	Total	0.191	11.5

Other Checks

	Number	Mean	Std. Dev.
LTB	37	0.068	0.233

Phenolics; 4-AAP (E3179)

QC Data; 2005/1/1 to 2005/12/31



PHOSPHOROUS, REACTIVE ortho-PHOSPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3364	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.2 at the full scale level.

Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.

Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.0005	Current T value: 0.0025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by "Labtronics" Data Aquisition software in August 1999.

Phosphorus; phosphate (E3364)

Analytical Range: to 0.100 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	67	0.08	0.0793	-0.0007	0.0009
B	67	0.04	0.0406	0.0006	0.0011
C	67	0.008	0.0081	0.0001	0.0006
A + B		0.12	0.12	0	0.0017
A - B		0.04	0.0387	-0.0013	0.0011
B + C		0.048	0.0487	0.0007	0.0015
B - C		0.032	0.0325	0.0005	0.0009

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.001
	Within Runs	0.0008
	Between/Within	1.25
s.d.(BC)	Between Runs	0.0009
	Within Runs	0.0006
	Between/Within	1.5

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.1224	0.1176	0.1248	0.1152
A - B	0.0424	0.0376	0.0436	0.0364
B + C	0.0496	0.0464	0.0512	0.0448
B - C	0.0332	0.0302	0.0344	0.0296

Duplicates

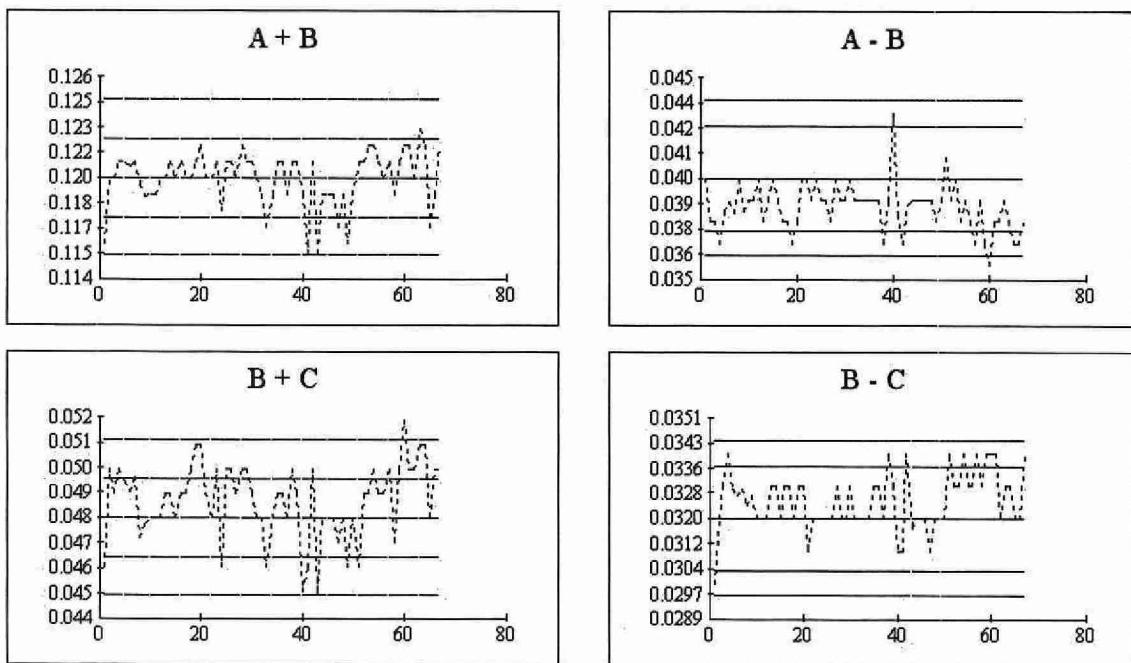
Number	Concentration	Std. Dev.	% Coeff of Var
118	0 - 10%	0.001	38.8
14	10 - 20%	0.001	7.1
7	20 - 50%	0.001	3.3
12	50 - 100%	0.002	2.6
151	Total	0.001	9.2

Other Checks

Number	Mean	Std. Dev.
LTB	67	0.0004

Phosphorus: phosphate (E3364A)

QC Data; 2005/1/1 to 2005/12/31



PHOSPHORUS, REACTIVE ortho-PHOSPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3366	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.5 at the full scale level.

Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.

Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in October 1999.

Surface Water was added in October 2005.

Phosphorus; phosphate (E3366)

Analytical Range: to 10.0 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	8	8.0141	0.0141	0.0615
B	46	4	4.0407	0.0407	0.0361
C	46	0.8	0.8065	0.0065	0.0162
A + B		12	12.0548	0.0548	0.071
A - B		4	3.9735	-0.0265	0.0717
B + C		4.8	4.8472	0.0472	0.0387
B - C		3.2	3.2341	0.0341	0.0404

Between Run VS Within Run Standard

Deviations

s.d.(AB)	Between Runs	0.0504
	Within Runs	0.0507
	Between/Within	0.9941
s.d.(BC)	Between Runs	0.028
	Within Runs	0.0286
	Between/Within	0.979

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.143	11.857	12.287	11.713
A - B	4.143	3.857	4.215	3.785
B + C	4.881	4.719	4.962	4.638
B - C	3.281	3.119	3.321	3.079

Duplicates

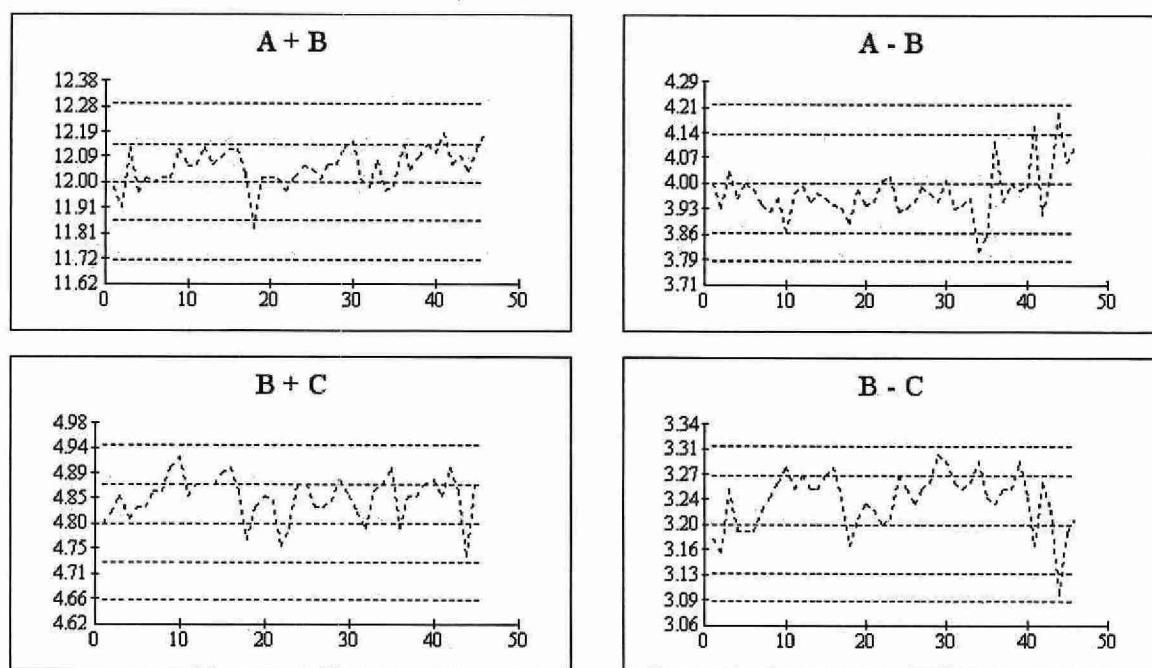
Number	Concentration	Std. Dev.	% Coeff of Var
99	0 - 10%	0.019	20.8
7	10 - 20%	0.06	4
7	20 - 50%	0.074	3.1
0	50 - 100%	N/A	N/A
113	Total	0.03	9.4

Other Checks

	Number	Mean	Std. Dev.
LTB	46	-0.0254	0.0201

Phosphorus: phosphate (E3366A)

QC Data; 2005/1/1 to 2005/12/31



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as P
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge and vegetation		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to orthophosphate by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

Hot plate

Basic automated modular continuous flow system : Colourimetric measurement is through a 5 cm. light path at 660 nm.

Data capture and processing is via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Drift	Run 80% calibration standard for every 10 samples
Recovery	3 digested BL's plus 4 digested standards R1, R2, R3 and R4

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC were introduced in April 2003. February 2004, Method E3118 was amalgamated with E3116. Data capture/processing is done by the "Labtronics" Data Aquisition software.

Phosphorus; total (E3116)

Analytical Range: to 2.0 mg/g as P

CALIBRATION CONTROL: (mg/L as N)

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	17	1.6	1.608	0.008	0.014
B	17	0.8	0.805	0.005	0.007
C	17	0.2	0.199	-0.001	0.011
A + B		2.4	2.413	0.013	0.018
A - B		0.8	0.804	0.004	0.013
B + C		1	1.004	0.004	0.015
B - C		0.6	0.606	0.006	0.011

Between Run VS Within Run Standard

Deviations

s.d.(AB)	Between Runs	0.0113
	Within Runs	0.0092
	Between/Within	1.2283
s.d.(BC)	Between Runs	0.009
	Within Runs	0.0078
	Between/Within	1.1538

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.432	2.368	2.464	2.336
A - B	0.832	0.768	0.848	0.752
B + C	1.015	0.985	1.03	0.97
B - C	0.615	0.585	0.622	0.578

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
0	0 - 10%	N/A	N/A
4	10 - 20%	0.019	6.3
27	20 - 50%	0.048	6.6
19	50 - 100%	0.036	3
51	Total	0.043	4.7

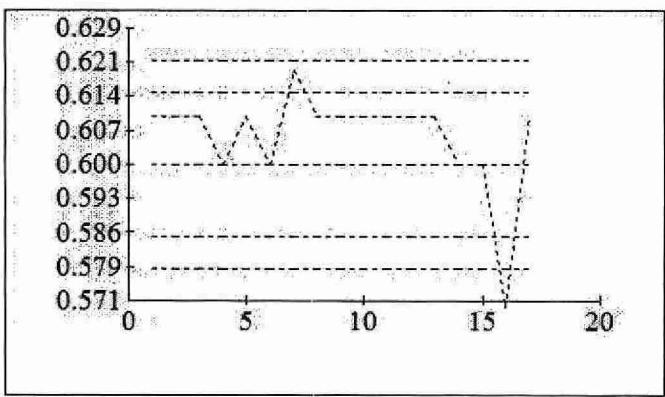
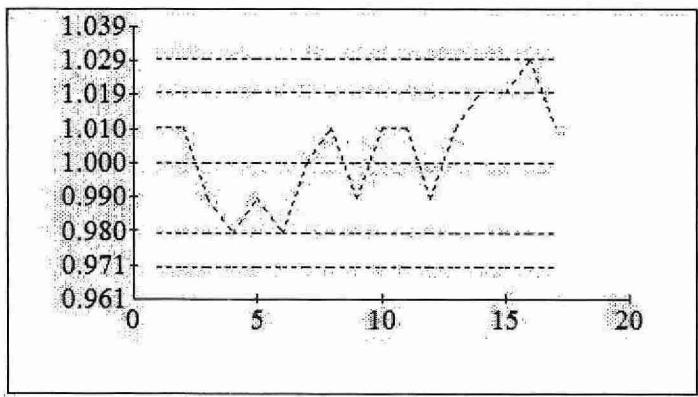
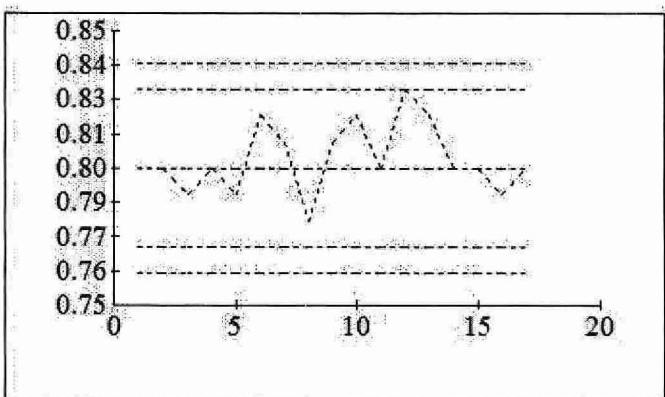
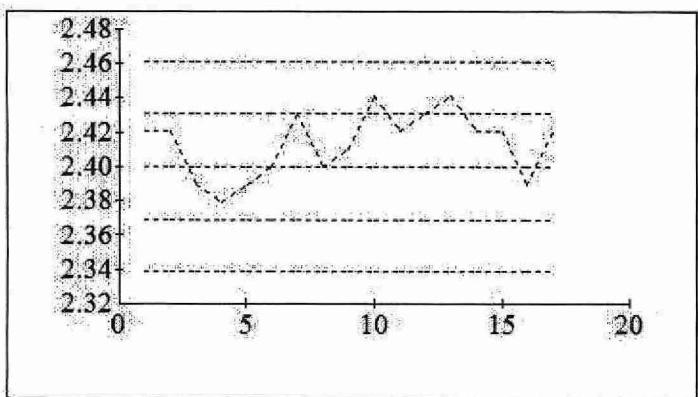
Recoveries

Number	Expected	Mean	Std. Dev.
17	1.05	1.059	0.027
17	0.47	0.46	0.021
17	24	25.138	0.906

Other Checks	Number	Mean	Std. Dev.
LTB	17	0.004	0.012
Digested Blank	17	0.012	0.009

Phosphorus: total (E3116)

QC Date: 2005/1/1 to 2005/12/31



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3367	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digesters kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.4 at the full scale level.

Total Kjeldahl nitrogen is determined simultaneously.

INSTRUMENTATION:

Three Block digesters

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using appropriate phototube.

Data capture and processing is via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.002	Current T value: 0.010
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL , undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in May 1999.

Phosphorus; total (E3367)

Analytical Range: to 0.200 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	57	0.16	0.16	0	0.0007
B	57	0.08	0.08	0	0.0005
C	57	0.016	0.015	-0.001	0.0006
A + B		0.24	0.24	0.00	0.0009
A - B		0.08	0.08	0	0.0008
B + C		0.096	0.095	-0.001	0.0009
B - C		0.064	0.065	0.001	0.0007

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.001
	Within Runs	0.0007
	Between/Within	1.4286
s.d.(BC)	Between Runs	0.0008
	Within Runs	0.0007
	Between/Within	1.1429

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.2434	0.2366	0.2468	0.2332
A - B	0.0834	0.0766	0.0851	0.0749
B + C	0.098	0.094	0.10	0.092
B - C	0.066	0.062	0.067	0.061

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
124	0 - 10%	0.003	33.9
22	10 - 20%	0.002	7.6
14	20 - 50%	0.002	3.5
4	50 - 100%	0.015	11.6
164	Total	0.003	16.4

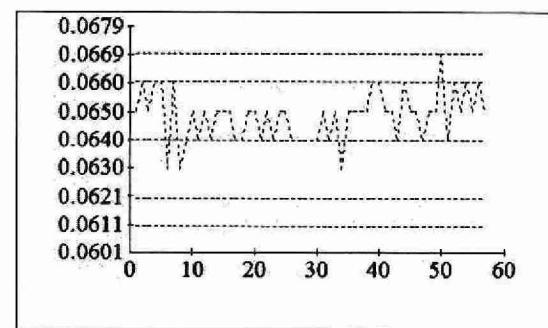
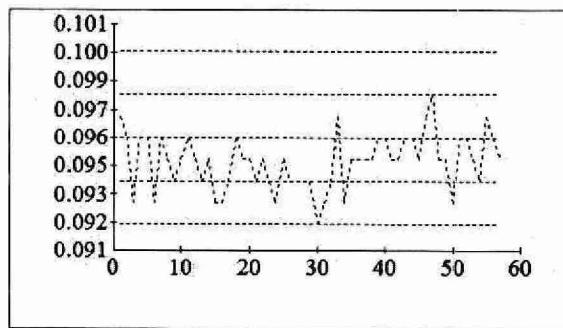
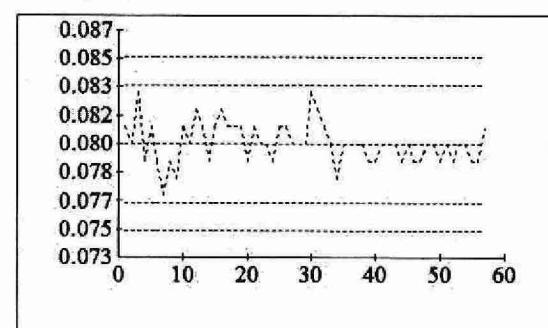
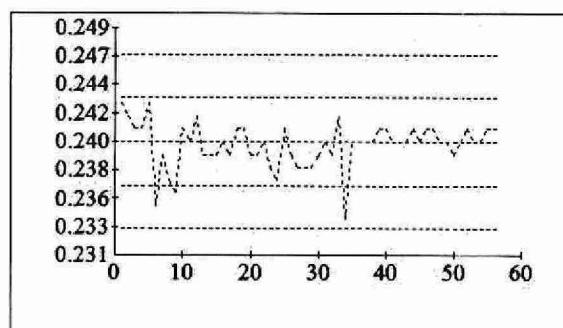
Recoveries

Number	Expected	Mean	Std. Dev.
57	0.14	0.138	0.003
57	0.084	0.083	0.003
57	0.028	0.028	0.002

Other Checks	Number	Mean	Std. Dev.
LTB	57	0	0.001
Digested Blank	57	0.001	0.001

Phosphorus: total (E3367A)

QC Data: 2005/1/1 to 2005/12/31



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3368	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate, Precipitation, Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.8 at the full scale level.

Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

3-Block digesters

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using an IR sensitive phototube. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,undigested standard, BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

The HP capture / processing system was replaced by "Labtronics" Data Aquisition software in April 1999
WP and WS matrices were added in October 2005.

Phosphorus; total (E3368)

Analytical Range: to 10.0 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	39	8	7.984	-0.016	0.028
B	39	4	3.993	-0.007	0.023
C	39	0.8	0.798	-0.002	0.011
A + B		12	11.977	-0.023	0.041
A - B		4	3.992	-0.008	0.031
B + C		4.8	4.791	-0.009	0.023
B - C		3.2	3.195	-0.005	0.027

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0255
	Within Runs	0.0219
	Between/Within	1.1644
s.d.(BC)	Between Runs	0.0178
	Within Runs	0.0191
	Between/Within	0.9319

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.065	11.935	12.13	11.87
A - B	4.065	3.935	4.097	3.903
B + C	4.834	4.766	4.868	4.732
B - C	3.234	3.166	3.251	3.149

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
95	0 - 10%	0.022	13.7
7	10 - 20%	0.013	0.9
3	20 - 50%	0.019	0.7
2	50 - 100%	N/A	N/A
107	Total	0.021	4.8

Recoveries

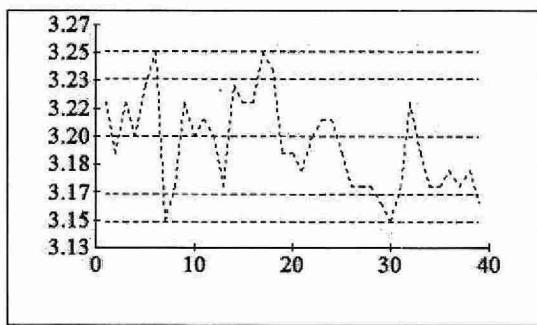
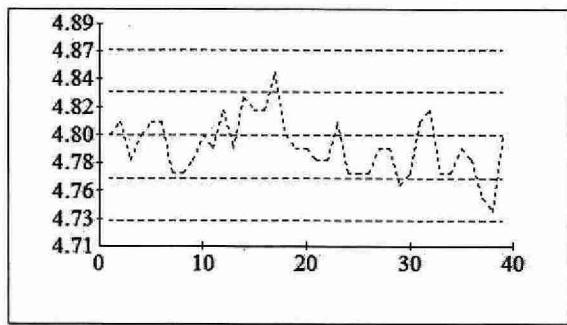
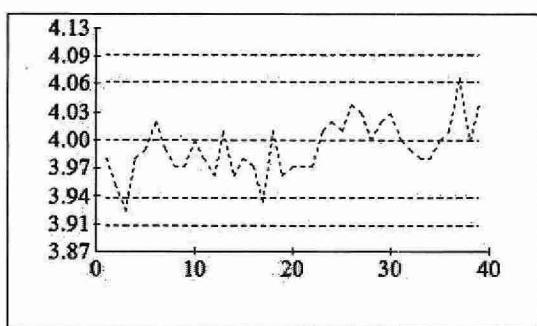
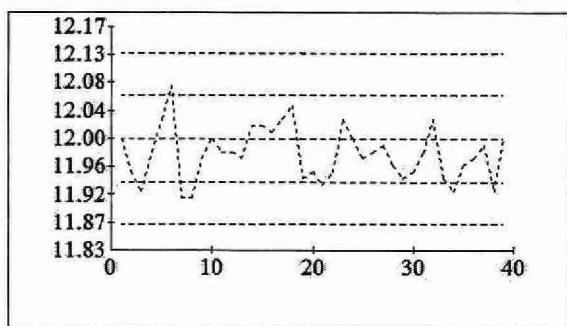
Number	Expected	Mean	Std. Dev.
39	7	6.847	0.104
39	4.2	4.134	0.052
39	1.4	1.389	0.026

Other Checks

	Number	Mean	Std. Dev.
LTB	39	0.007	0.014
Digested Blank	39	0.005	0.013

Phosphorus; total (E3368A)

QC Data: 2005/1/1 to 2005/12/31



SILICON, REACTIVE SILICATES

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/02/75
Method Reference No.	E3370	Reporting Unit	mg/L as Si
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Reactive silicates are determined by formation of a reduced molybdo-silicate complex at pH 1.6, using ascorbic acid as the reducing agent, and oxalic acid to suppress phosphate interference.

Approximate absorbance: 0.7 at the full scale level.

Dissolved inorganic and dissolved organic carbon are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 660 nm. Data capture and processing is via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL, standard and BL every 10 samples.

NOTES:

December 1998: The HP data capture/processing system was replaced by "Labtronics" Data Aquisition software.

Silicon; reactive silicate (E3370)**Analytical Range: to 10.0 mg/L as Si****CALIBRATION CONTROL:**

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	58	8	7.993	-0.007	0.028
B	58	2	2.012	0.012	0.025
C	58	0.5	0.487	-0.013	0.018
A + B		10	10.005	0.005	0.04
A - B		6	5.982	-0.018	0.035
B + C		2.5	2.499	-0.001	0.041
B - C		1.5	1.524	0.024	0.016

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0266
	Within Runs	0.0247
	Between/Within	1.0769
s.d.(BC)	Between Runs	0.0219
	Within Runs	0.0113
	Between/Within	1.9381

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	10.17	9.83	10.34	9.66
A - B	6.17	5.83	6.25	5.75
B + C	2.57	2.43	2.63	2.37
B - C	1.57	1.43	1.6	1.4

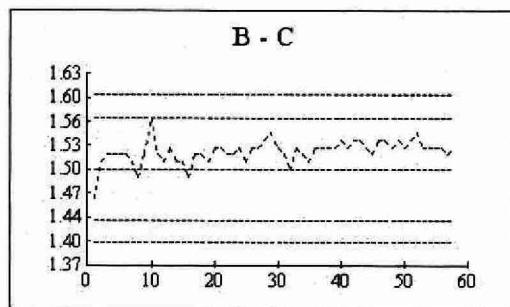
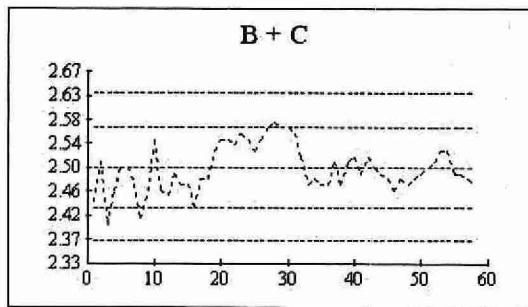
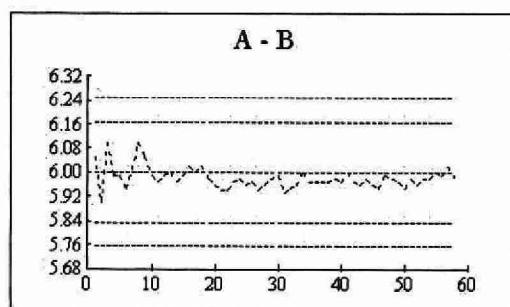
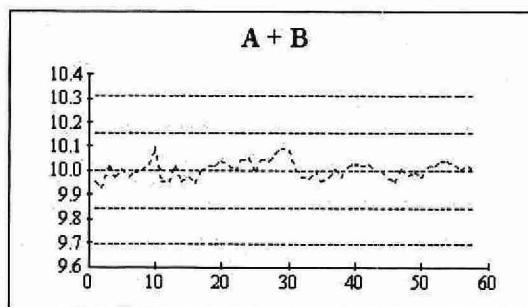
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
70	0 - 10%	0.011	2.3
40	10 - 20%	0.009	0.6
30	20 - 50%	0.02	0.6
19	50 - 100%	0.015	0.2
160	Total	0.014	0.7

Other Checks	Number	Mean	Std. Dev.
LTB	58	-0.027	0.03

Silicon; reactive silicate [E3370A]

QC Data: 2005/1/1 to 2005/12/31



SOLIDS, DISSOLVED

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188,DS3188,DIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sample is filtered under moderate suction through a Whatman 934AH grade glass fibre filter. Generally 100 mL of filtrate (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at $103\pm2^{\circ}\text{C}$, and stored in a desiccator for at least 24 hours. The dissolved solids content is calculated by subtracting the original dish mass from the dried residue + dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), drying oven, suction filtration apparatus, dishes (Teflon). Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2	Current T value: 10
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CALIBRATION:

Balance zero
Balance internal calibration is performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1
Method Blank	100 mL Pure Water.

SOLIDS, DISSOLVED (E3188)

QUALITY CONTROL DATA FROM 01/04/05 TO 12/29/05

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	63	50.00	50.00002	0.00002	0.00005
B:	63	30.00	30.00005	0.00005	0.00005
A+B:		80.00	80.00007	0.00007	0.00007
A-B:		20.00	19.99997	-0.00003	0.00007

s.d.(AB) S(between runs): 0.00005 Sw(within run): 0.00005 S/Sw: 1.0

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

79.9999 - 80.0004 for A+B
19.9998 - 20.0002 for A-B

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
63	2000.0	1991.42	14.67
62	500.0	494.56	8.10

DUPLICATES:

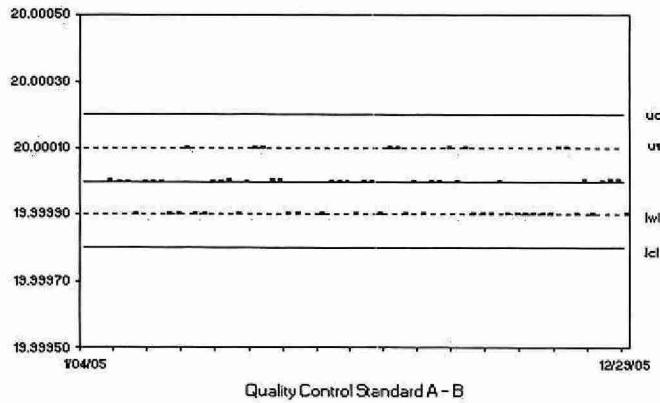
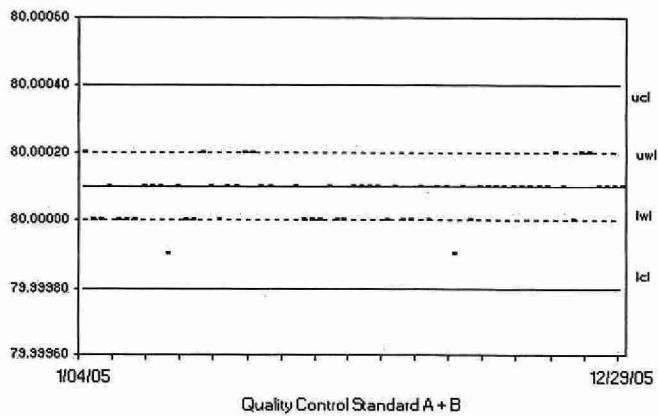
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
13	0 - 500	9.0105	2.9
103	501 - 1000	11.4029	1.7
32	1001 - 5000	37.4362	2.2
3	5001 - 25000	56.5440	0.8
151	Overall	21.3590	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	62	0.02935	5.01086

DISSOLVED, SOLIDS (E3188)

QUALITY CONTROL DATA FROM 01/04/05 TO 12/29/05



SOLIDS, SUSPENDED

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188, SS3188	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

5 to 500 mL is pipetted or quickly poured from a shaken sample into a graduated cylinder, and the volume is measured. The aliquot is then filtered under moderate suction through a preweighed Whatman 934AH glass fibre filter. The graduated cylinder and then the filter are washed with a total of 50 mL distilled water. The filter is dried at 103-105°C, and the suspended solids content is calculated by subtracting the original filter mass from the dried filter mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5-decimal places), drying oven, suction filtration apparatus.
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1
Method Blank	Filter washed with 500 mL distilled water

NOTES:

A standard correction factor (-0.00018g) was applied to all filters to account for weight loss during filtering.
A new set of Q.C. weights was introduced for the year 2003, along with new limits for the weights.

SOLIDS, SUSPENDED (E3188)

QUALITY CONTROL DATA FROM 01/06/05 TO 12/21/05

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
C:	398	0.50	0.50000	0.00000	0.00000
D:	398	0.05	0.05000	0.00000	0.00000
C+D:		0.55	0.55000	0.00000	0.00001
C-D:		0.45	0.45000	0.00000	0.00001

s.d.(CD) S(between runs): 0.00001 Sw(within run): 0.00001 S/Sw: 1.0

The calibration is accepted if the calibration control values (mean mass measured) obtained are within the ranges expressed in grams:

$$\begin{array}{lll} 0.54997 & - & 0.55003 \text{ for C+D} \\ 0.44998 & - & 0.45002 \text{ for C-D} \end{array}$$

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
397	200.0	195.01	1.9507
397	50.0	48.59	0.9913

DUPLICATES:

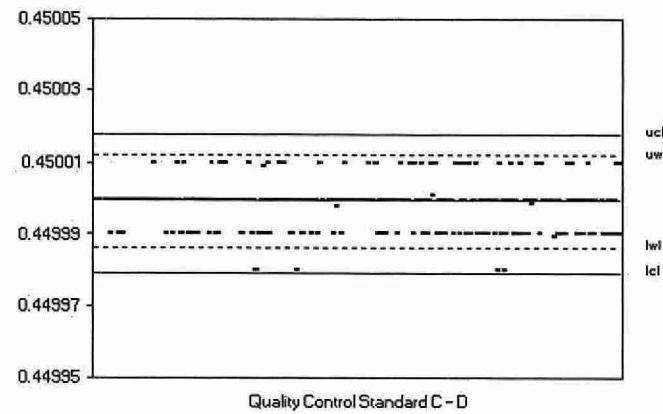
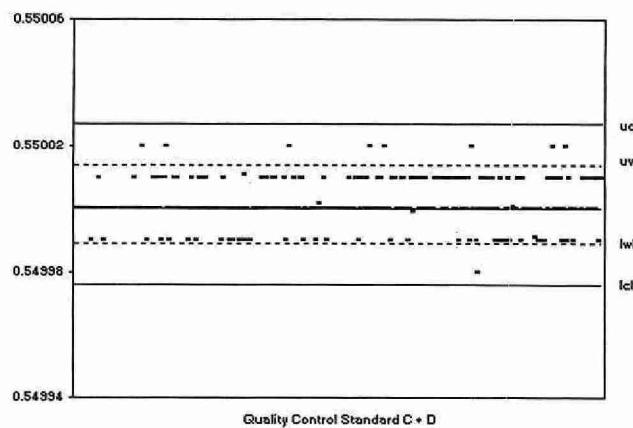
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
403	0 - 5	0.2185	9.5
213	5.1 - 10	0.4538	6.3
268	10.1 - 25	0.8082	5.2
194	25.1 - 100	1.6087	3.3
53	100.1 - 500	11.7748	5.3
16	501 - 1000	24.7556	3.6
22	1001 - 5000	125.9579	4.3
1169	Overall	17.7168	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	398	-0.0217	0.1044

SOLIDS, SUSPENDED (E3188)

QUALITY CONTROL DATA FROM 01/06/05 TO 12/21/05



SOLIDS, SUSPENDED IGNITED
(Particulate Ash and Particulate Loss On Ignition)

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	SIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

The procedure for particulate solids (SS3188) is followed and the dried residue is ignited at $600\pm50^{\circ}\text{C}$ for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The particulate ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for SS3188. The particulate loss on ignition (estimate of volatile suspended solids) is the difference between the final ignited mass plus filter and the residue (suspended solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes
 Computer system with appropriate software

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the computer.

SOLIDS, SUSPENDED IGNITED (E3188)
(Particulate Ash and Particulate Loss On Ignition)

QUALITY CONTROL DATA FROM 01/04/05 TO 12/21/05

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
C:	87	0.50	0.50000	0.00000	0.000005
D:	87	0.05	0.05000	0.00000	0.000006
C+D:		0.55	0.55000	0.00000	0.000009
C-D:		0.45	0.45000	0.00000	0.000005

s.d.(CD) S(between runs): 0.000005 Sw(within run): 0.000005 S/Sw: 1.00

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

0.54998 - 0.55003 for C+D
0.44998 - 0.45002 for C-D

SOLIDS, SUSPENDED IGNITED (PARTICULATE ASH)

DUPPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
185	0 - 10.0	0.5136	15.5
33	10.1 - 20.0	0.9020	6.4
19	20.1- 100.0	1.5389	4.8
16	100.1 - 1000	12.7606	2.9
4	1001 - 2000	30.7090	2.4
257	Overall	5.0284	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	87	0.27	0.195

SOLIDS, SUSPENDED IGNITED (PARTICULATE LOSS ON IGNITION)

DUPPLICATES:

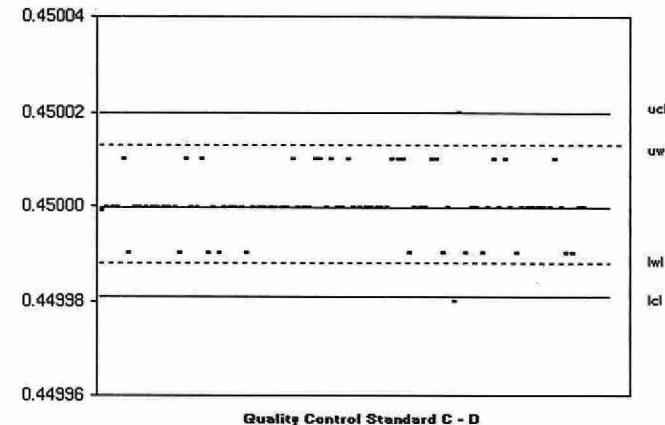
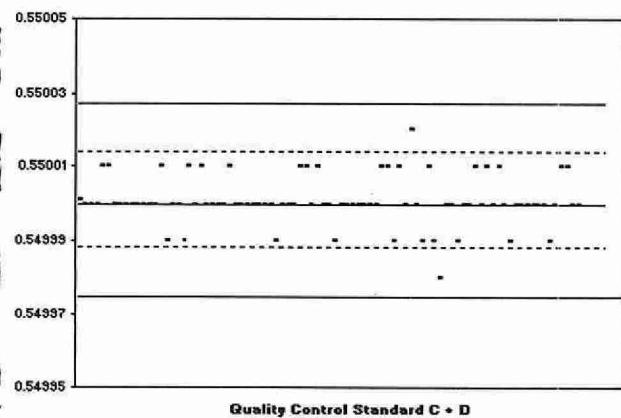
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
113	0 - 10.0	0.4110	7.7
44	10.1 - 20.0	0.7805	6.0
82	20.1 - 100.0	1.7086	3.5
18	100.1 - 1000	11.6088	6.2
257	Overall	3.2479	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	87	-0.28	0.287

Solids, Suspended Ignited (E3188)
(Particulate Ash and Particulate Loss on Ignition)

QUALITY CONTROL DATA FROM 01/04/05 TO 12/21/05



SOLIDS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L or mg/Kg
LIMS Product Code	TS3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Generally, 100 mL aliquot of sample (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103-105°C, and stored in a desiccator for at least 24 hours. The total residue or solids content is calculated by subtracting the original dish mass from the dried dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), drying oven, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0	Current T value: 10.0
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CALIBRATION:

Balance zero
Balance internal calibration performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the computer.
Recovery	2 standards, e.g. R1

SOLIDS, TOTAL (E3188)

QUALITY CONTROL DATA FROM 01/05/05 TO 11/24/05

CALIBRATION CONTROL: (QC data from TS3188)

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	12	50.00	50.0000	0.00000	0.00000
B:	12	30.00	30.00004	0.00004	0.00005
A+B:		80.00	80.00004	0.00004	0.00005
A-B:		20.00	19.99996	-0.00004	0.00005

s.d.(AB) S(between runs): 0.00004 Sw(within run): 0.00004 S/Sw: 1.0

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

79.9998 - 80.0002 for A+B
19.99985 - 20.0002 for A-B

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
12	20000.0	20184.63	137.38
12	2000.0	1998.98	10.29

DUPLICATES:

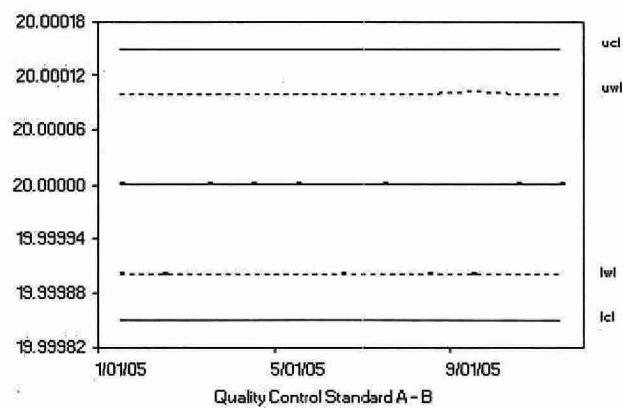
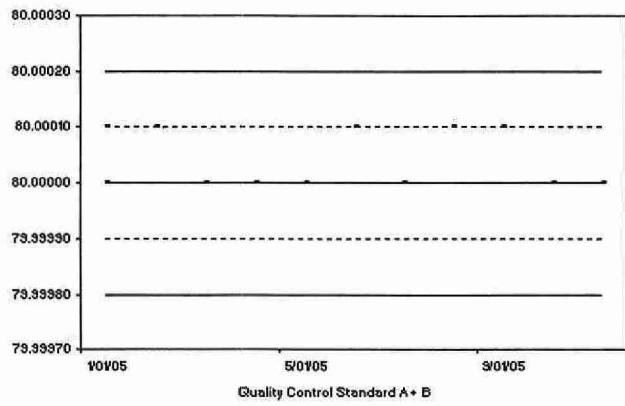
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
13	0 - 6000	27.6256	1.3
8	6001 - 20000	106.0485	0.8
6	20001 - 30000	46.4490	0.2
27	Overall	64.6462	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	12	-0.5333	4.0999

SOLIDS, TOTAL (E3188)

Quality Control Data From 01/05/05 To 11/24/05



SOLIDS, TOTAL IGNITED (Ash and Loss On Ignition)

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

The procedure for total solids (TS3188) is followed and the dried residue is ignited at $600\pm50^{\circ}\text{C}$ for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The ash (fixed solids) is the difference between the final ignited mass dish and the original tare weight of the dish, divided by the original sample volume (mL) used for TS3188. The loss on ignition (estimate of volatile total solids) is the difference between the final ignited mass plus dish and the residue (total solids) plus dish, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), muffle furnace, filters, Petri dishes.
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0	Current T value: 10.0
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.

SOLIDS, TOTAL IGNITED (E3188)
(Ash and Loss On Ignition)
 QUALITY CONTROL DATA FROM 01/04/05 TO 12/21/05

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	49	50.00	50.0000	0.0000	0.00004
B:	49	30.00	30.0001	0.0001	0.00005
A+B:		80.00	80.0001	0.0001	0.00006
A-B:		20.00	19.9999	-0.0001	0.00006

s.d.(AB) S(between runs): 0.00004 Sw(within run): 0.00004 S/Sw: 1.0

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

$$\begin{array}{lll} 79.99986 & - & 80.00034 \text{ for A+B} \\ 19.9997 & - & 20.0001 \text{ for A-B} \end{array}$$

SOLIDS, TOTAL IGNITED (DRY)

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
44	20000.0	19968.59	124.01
49	2000.0	2000.33	13.67

DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
16	0 - 500	4.5172	1.0
20	501 - 1000	23.6170	3.8
45	1001 - 5000	45.0210	1.8
39	5001 - 10000	94.5844	1.4
27	10001 - 75000	240.1239	1.2
147	Overall	116.8871	

SOLIDS, TOTAL IGNITED cont'd
(Ash and Loss On Ignition)

SOLIDS, TOTAL IGNITED (ASH)

DUPPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
31	0 - 500	19.06948	5.5
23	501 - 1000	11.12335	1.4
75	1001 - 5000	54.60232	2.4
13	50001 - 10000	107.5747	1.5
5	10001 - 55000	162.5866	0.6
147	Overall	59.49543	

OTHER CHECKS:

Ashed	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	48	4.8333	3.91

SOLIDS, TOTAL IGNITED (LOSS ON IGNITION)

DUPPLICATES:

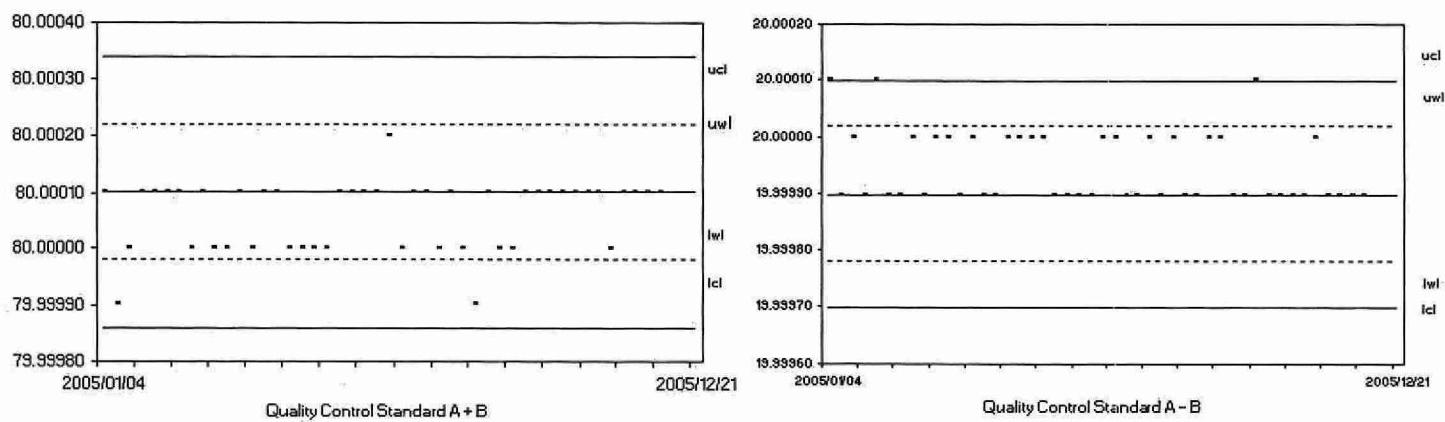
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
52	0 - 500	12.8185	6.3
6	501 - 1000	13.2067	1.9
55	1001 - 5000	61.2072	2.0
21	5001 - 10000	147.0258	2.2
12	10001 - 55000	274.4282	1.7
146	Overall	103.8082	

OTHER CHECKS:

LOI	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	48	-1.7125	7.4252

SOLIDS, TOTAL IGNITED (E3188)

Quality Control Data From 01/04/05 To 12/21/05



SULPHATE

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu\text{g}/\text{m}^3$ as SO_4
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Sulphate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu\text{g}/\text{m}^3$ as SO_4 .

Chloride and nitrate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1 $\mu\text{g}/\text{m}^3$	Current T value: 0.5 $\mu\text{g}/\text{m}^3$
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CALIBRATION:

9 standards

CONTROLS:

Calibration	MB, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of SO_4 in $\mu\text{g}/\text{m}^3$ is calculated by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

SULFATE (E3004)

QUALITY CONTROL DATA FOR 01/12/04 TO 12/02/05

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	49	80	79.8635	-0.1365	0.8286
B:	49	20	19.8854	-0.1146	0.2897
A+B:		100	99.7489	-0.2511	1.0496
A-B:		60	59.9782	-0.0218	0.6629

s.d.(AB) S(between runs): 0.62 Sw(within run): 0.47 S/Sw: 1.32

On any given day the calibration is accepted if the values obtained lie within the ranges:

98.24 - 101.76 for A+B
58.68 - 61.32 for A-B

In House Control standard data for 01/03/05 to 12/02/05: (mg/L)

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
CS4	18	40.30	40.95	0.6511	1.0609
CS5	17	34.68	34.09	-0.5935	0.4106

The standards are accepted if the control values obtained lie within the ranges:

35.86 - 44.74 for CS4
33.64 - 35.73 for CS5

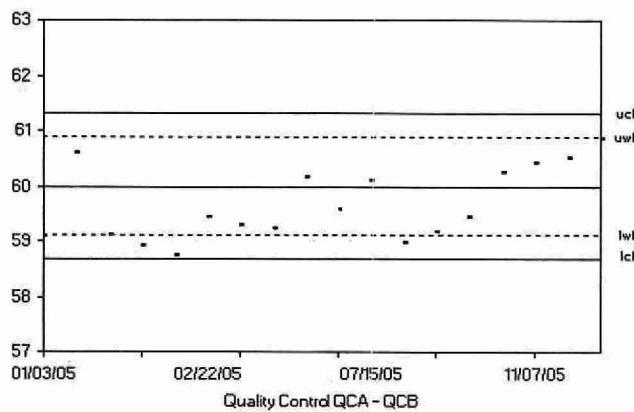
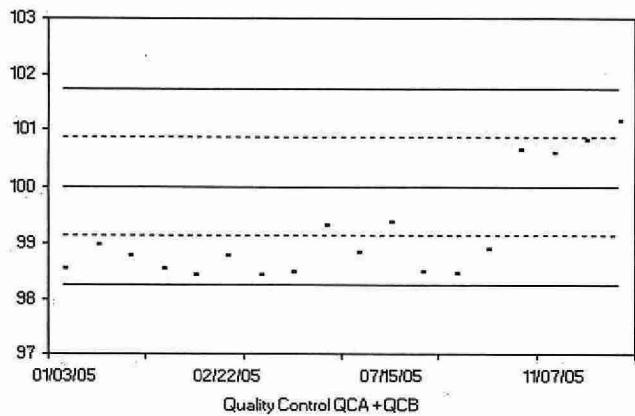
DUPLICATES: ($\mu\text{g}/\text{m}^3$)

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
19	0.00 - 2.86	0.0408	2.7
19	2.89 - 7.15	0.0560	1.5
6	7.18 - 14.31	0.2807	2.8
12	14.33 - 28.61	0.6319	3.2
52	Overall	0.3205	4.3

SULPHATE (E3004)

QUALITY CONTROL DATA FROM 01/03/05 TO 12/02/05

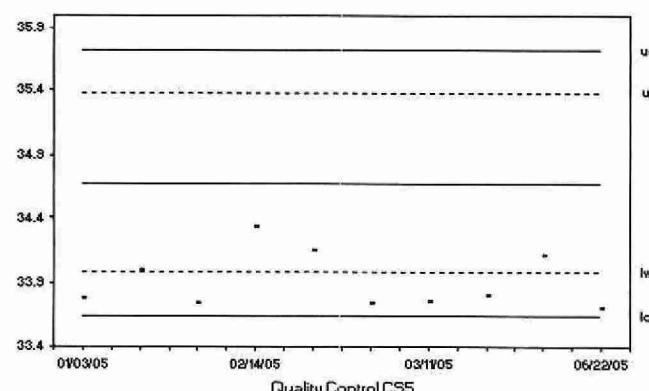
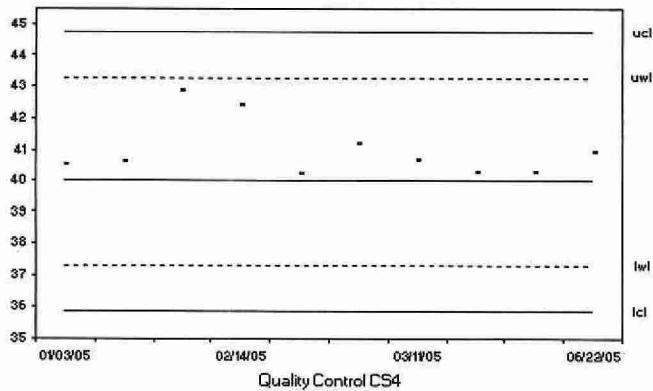
Analytical Range: to 100 mg/L



SULPHATE (E3004)

QUALITY CONTROL DATA FROM 01/03/05 TO 12/02/05

Analytical Range For CS Controls: to 28.61 mg/L



SULPHATE

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	31412
Method Reference No.	E3013	Units	$\mu\text{g/g}$ as SO_4
LIMS Product Code	ANION3013, SUL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic

SAMPLING PREPARATION:

A 3.0 g sample of air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to those of a series of standards. The result is reported as $\mu\text{g/g}$ as SO_4 . Chloride is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5 $\mu\text{g/g}$	Current T value: 2.5 $\mu\text{g/g}$
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CALIBRATION:

9 standards

CONTROLS:

Calibration	MB, QCA and QCB
Recovery	R21, SO201, SO202
Drift	2 standards every 20 samples

Note: R21, SO201 and SO202 were introduced October, 2003.

SULFATE (E3013)

QUALITY CONTROL DATA FOR 06/25/03 TO 12/02/05

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	36	80	79.48	-0.52	0.5831
B:	36	20	20.04	0.04	0.3498
A+B:		100	99.53	-0.47	0.6313
A-B:		60	59.44	-0.56	0.7254

s.d.(AB) S(between runs): 0.48 Sw(within run): 0.51 S/Sw: 0.94

The calibration is accepted if the calibration control values obtained lie within the ranges:

98.24 - 101.76 for A+B
58.68 - 61.32 for A-B**DUPLICATES: (µg/g)**

For 2005 only

n Data Pairs	Sample Concentration Span (µg/g)	Standard Deviation (2)	Coefficient of variation(%)
7	0.00 - 200	0.6621	0.7
0	201 - 500	N.A.	N.A.
1	501 - 1000	N.A.	N.A.
8	Overall	1.7269	

RECOVERIES: (µg/g)

October 2003 to October 2005

	n Data Pairs	Expected Concentration	Mean Concentration	Standard Deviation (1)
R21	11	44.6	46.61	7.9610
SO201	10	73.2	79.70	3.6913
SO202	10	445.4	381.87	38.5904
R21	11	44.6	46.61	7.9610
R16	7	46.4	41.47	2.9618
R23	9	5400	5385.81	239.9554

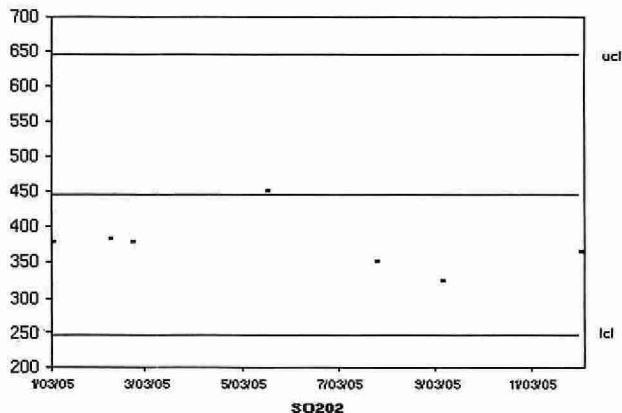
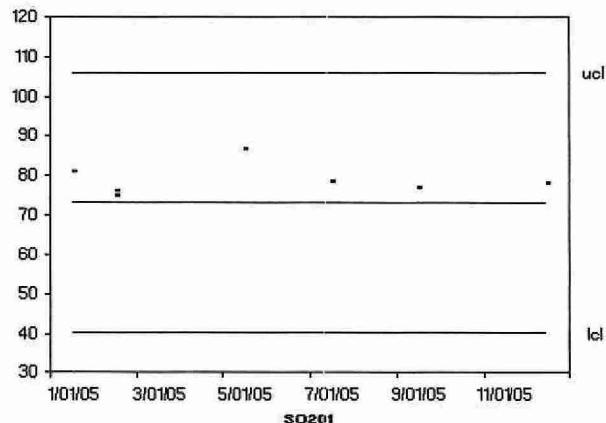
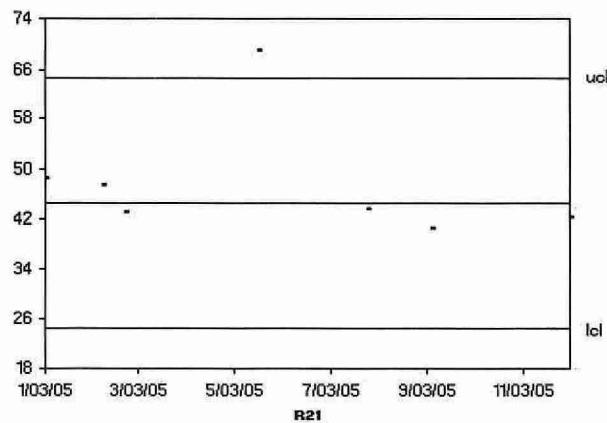
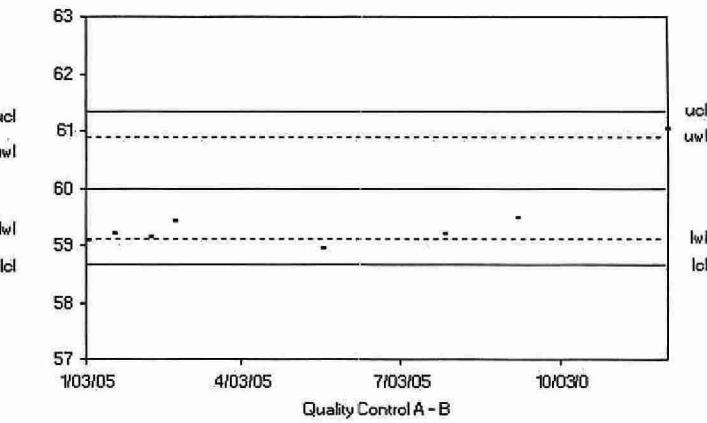
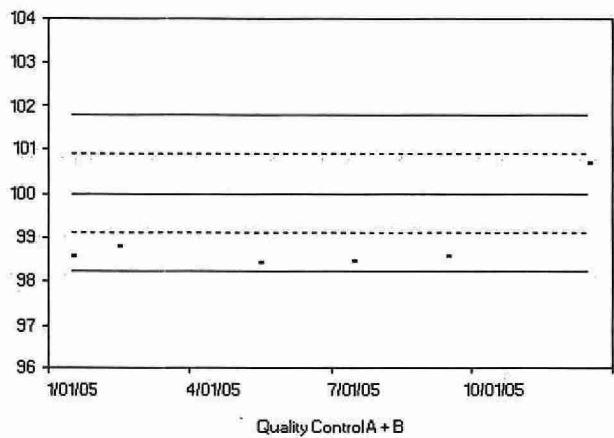
The calibration is accepted if the calibration control values obtained lie within the ranges:

24.5	-	64.7	for	R21
40.3	-	106.1	for	SO201
245	-	645.8	for	SO202

SULPHATE (E3013)

QUALITY CONTROL DATA FROM 01/03/05 TO 12/22/05

Analytical Range: to 100 mg/L



SULPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	29954
Method Reference No.	E3172	Reporting Unit	mg/L as SO ₄
LIMS Product Code	SULP3172, Anion3172	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.001 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detection. The concentration of sulphate in mg/L as SO₄ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for automated sample introduction, timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/23/05

Analytical Range: to 100.0 mg/L as SO₄

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	83	80.0	80.16	0.16	0.42
B:	83	40.0	40.05	0.05	0.41
C:	83	8.0	8.16	0.16	0.16
A+B:		120.0	120.20	0.20	0.61
A-B:		40.0	40.11	0.11	0.56
B+C:		48.0	48.41	0.41	0.47
B-C:		32.0	32.36	0.36	0.41

s.d.(AB) S(between runs): 0.42 Sw(within run): 0.40 S/Sw: 1.04
 s.d.(BC) S(between runs): 0.31 Sw(within run): 0.29 S/Sw: 1.08

The calibration is accepted if the calibration control values obtained lie within the ranges:

118.35	-	121.65	for	A+B
38.76	-	41.24	for	A-B
46.95	-	49.05	for	B+C
31.21	-	32.79	for	B-C

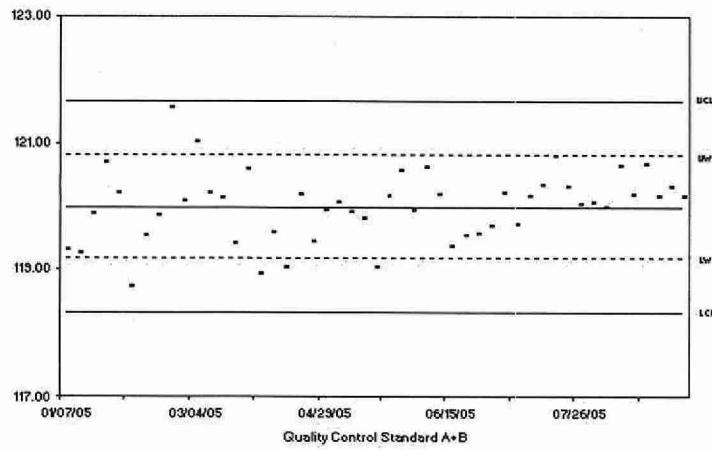
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
50	0.0 - 10.0	0.0985	2.0
54	10.1 - 20.0	0.2661	1.7
80	20.1 - 50.0	0.2706	0.9
39	50.1 - 100.0	0.7263	1.1
223	Overall	0.3713	

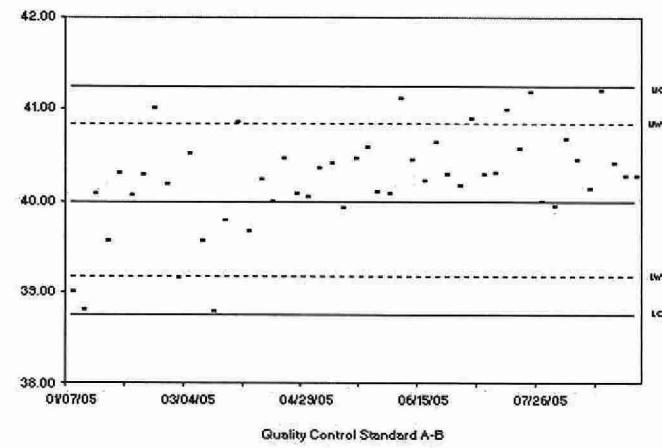
SULPHATE (E3172)

QUALITY CONTROL DATA FROM 01/07/05 TO 12/23/05

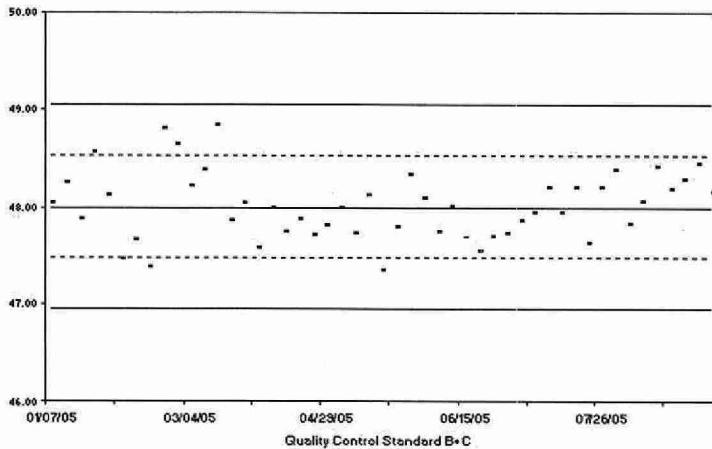
Analytical Range: to 100.0 mg/L as SO₄



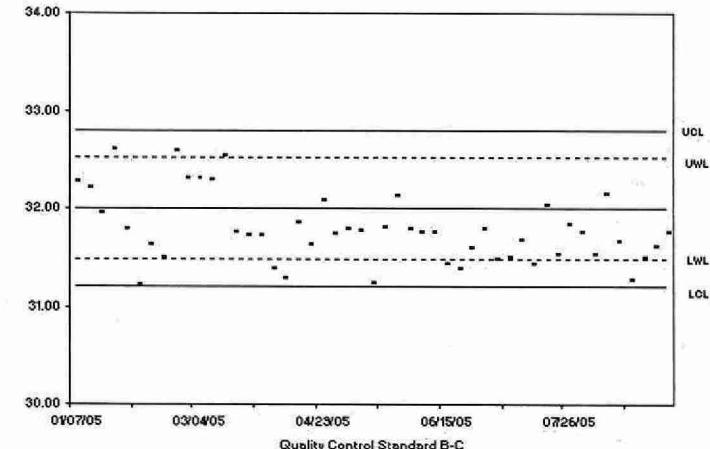
Quality Control Standard A+B



Quality Control Standard A-B



Quality Control Standard B+C



Quality Control Standard B-C

SULPHIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	June 89
Method Reference No.	E3100	Reporting Unit	µg/L as S ²⁻
LIMS Product Code	H2S3100	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Total Sulphide including H₂S, HS⁻ and any acid soluble metal sulphides which have been precipitated as ZnS during sample preservation. The precipitated sulphides (hydrogen sulphides) are dissolved in an alkaline absorbing solution and reacted with N,N-dimethyl-p-phenylenediamine dihydrochloride and ferric chloride to form methylene blue. The intensity of the methylene blue is compared to standards treated in the same manner.

INSTRUMENTATION:

Basic automated modular continuous flow colourimetric system, measurement through a 660 nm filter and a 50 mm flow cell (1.5mm ID).

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0 µg/L	Current T value: 10.0 µg/L
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CALIBRATION:

BL plus 5 standards

CONTROLS:

Calibration	Daily blank and 3 standards, e.g. QCA
Drift	Blank and sensitivity check standard approximately every 10 samples

Sulphide (E3100)

Analytical Range: to 100.0 ug/L as S

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	12	128	126.2825	-1.7175	12.2986
B	12	80	81.8875	1.8875	6.0167
C	12	32	34.9267	2.9267	6.4619
A + B		208	208.17	0.17	14.9289
A - B		48	44.395	-3.605	12.3305
B + C		112	116.8142	4.8142	10.9336
B - C		48	46.9608	-1.0392	6.0309

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	9.6813
	Within Runs	8.719
	Between/Within	1.1104
s.d.(BC)	Between Runs	6.2433
	Within Runs	4.2645
	Between/Within	1.464

Control Limits

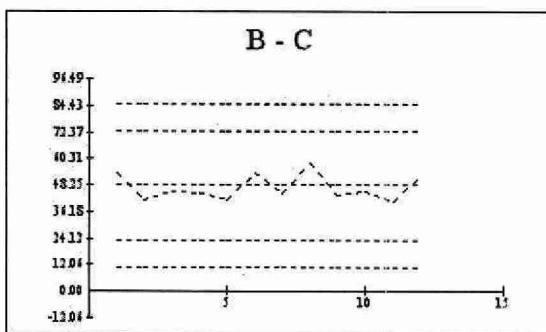
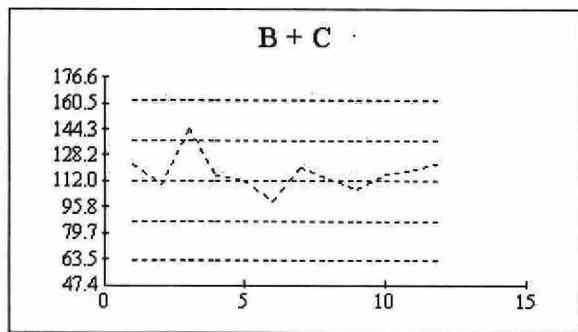
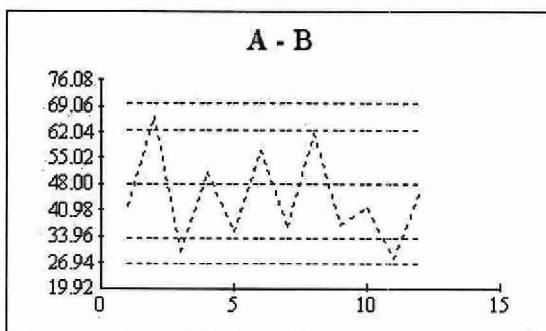
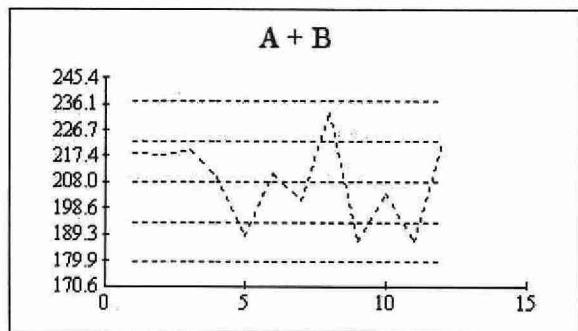
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	222.4	193.6	236.8	179.2
A - B	62.4	33.6	69.9	26.4
B + C	136.85	87.15	161.7	62.3
B - C	72.85	23.15	85.3	10.7

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
18	0 - 10%	3.047	48.9
4	10 - 20%	2.351	9.8
6	20 - 50%	3.065	5.9
2	50 - 100%	N/A	N/A
30	Total	3.091	12.8

Sulphide [E5326]

QC Data: 2005/1/1 to 2005/12/31



TURBIDITY

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '74
Method Reference No.	E3311	Reporting Unit	FTU
LIMS Product Code	TURB3311	Supervisor	P. Wilson
Sample Type/Matrix	Surface Water, Ground Water, Effluent, Drinking Water, Industrial Waste, Process Water, Leachate		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

The instrument is standardized with sealed standards which are prepared commercially and are rated in Formazin Turbidity Units. Samples are placed in the turbidimeter, and results in FTU are read directly from the digital output. Turbidity measurements are based on light scattering at 90° ($\pm 30^\circ$) rotation. The instrument compensates for sample colour.

INSTRUMENTATION:

-Hach Ratio/XR Model Turbidimeter modified to accept control signals from robot controller, electronic interface, Zymark ZYMATE 11 Laboratory Robot System and computer.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus formazin standards (once every four months). Calculated QC limits are specific to each standard set.

CONTROLS:

Calibration:	5 standards, e.g. QCA
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NOTES: QCA and QCD data for June 4th and 18th are outside the limits respectively. Samples were repeated in their respective range.

TURBIDITY (E3311)

QUALITY CONTROL DATA FROM 01/05/05 TO 12/23/05
Analytical Range: to 2000 FTU

CALIBRATION CONTROL:

		n	Expected Concentration	Mean Concentration	Standard Deviation (1)
A:	Jan	10	2.0	1.5536	0.0227
	Jan - Mar	30		1.4711	0.0123
	Mar - June	49		1.4868	0.0132
	June - July	30		1.4444	0.0219
	July - Sept	31		1.4767	0.0172
	Sept - Oct	30		1.4679	0.0106
	Oct - Dec	34		1.463	0.0172
B:	Jan	10	20.0	17.161	0.2074
	Jan - Mar	30		16.498	0.1763
	Mar - June	49		16.7331	0.1637
	June - July	30		16.352	0.2564
	July - Sept	31		16.7445	0.2782
	Sept - Oct	30		16.394	0.0980
	Oct - Dec	34		16.5368	0.0628
C:	Jan	10	200.0	150.16	0.7106
	Jan - Mar	30		146.8133	1.0275
	Mar - June	49		147.6673	0.9241
	June - July	30		148.3	1.9348
	July - Sept	31		150.929	2.0059
	Sept - Oct	30		144.89	0.7213
	Oct - Dec	34		145.0441	0.4974
D:	Jan	10	2000.0	1517.5	11.9559
	Jan - Mar	30		1540.333	9.1551
	Mar - June	49		1553.755	5.6367
	June - July	30		1527.4	8.9620
	July - Sept	31		1530.903	14.3651
	Sept - Oct	30		1512.567	6.4364
	Oct - Dec	34		1517.088	6.4355

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.576	-	1.462	for	A (Jan)
1.571	-	1.422		A (Jan - Mar)
1.510	-	1.433		A (Mar - June)
1.479	-	1.338		A (June - July)
1.507	-	1.379		A (July - Sep)
1.539	-	1.392		A (Sep - Oct)
1.500	-	1.436		A (Oct - Dec)

17.46	-	16.36	for	B (Jan)
17.64	-	15.96		B (Jan - Mar)
17.01	-	16.03		B (Mar - June)
16.85	-	15.24		B (June - July)
17.18	-	15.54		B (July - Sep)
17.20	-	15.56		B (Sep - Oct)
16.69	-	16.10		B (Oct - Dec)

152.2	-	146.1	for	C (Jan)
156.3	-	141.4		C (Jan - Mar)
150.0	-	143.9		C (Mar - June)
153.4	-	138.8		C (June - July)
154.2	-	142.0		C (July - Sep)
153.0	-	138.5		C (Sep - Oct)
147.1	-	142.7		C (Oct - Dec)

1537	-	1501	for	D (Jan)
1637	-	1481		D (Jan - Mar)
1568	-	1515		D (Mar - June)
1607	-	1454		D (June - July)
1555	-	1501		D (July - Sep)
1596	-	1444		D (Sep - Oct)
1532	-	1493		D (Oct - Dec)

	n	Data Mean	Standard Deviation (1)
Stray Light	214	0.00005	0.0004

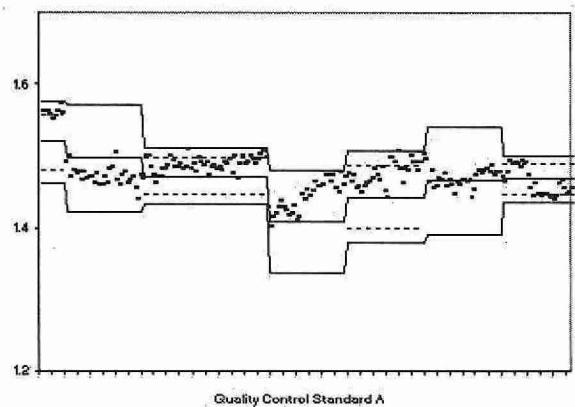
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
214	0.0 - 2.0	0.0510	6.2
253	2.1 - 20.0	0.3222	5.2
115	21.0 - 200	1.4835	2.5
15	201 - 2000	10.1719	1.8
597	Overall	1.7517	

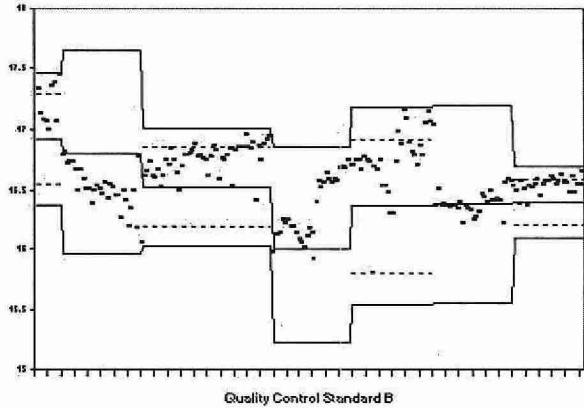
TURBIDITY (E3311)

QUALITY CONTROL DATA FROM 01/05/05 TO 12/23/05

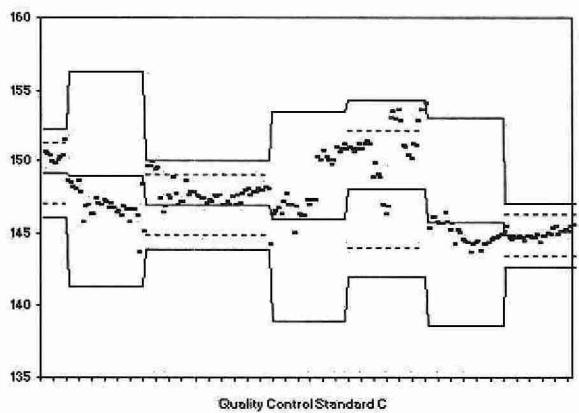
Analytical Range: to 2000 FTU



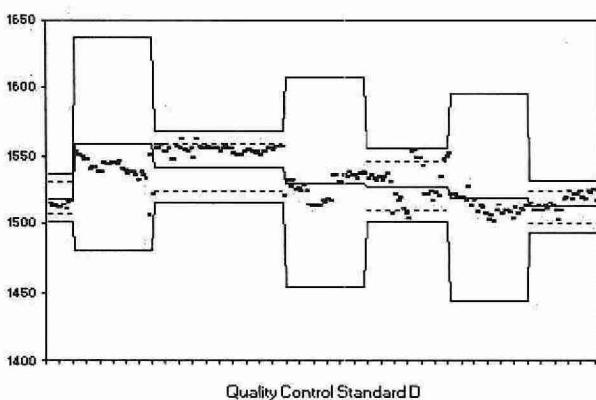
Jan Mar June July Sept Oct Dec



Jan Mar June July Sept Oct Dec



Jan Mar June July Sept Oct Dec



Jan Mar June July Sept Oct Dec

PART 3.0
MICROBIOLOGY

3.1 Quality Control Program, Microbiology Unit

Performance Criteria

Analyses of samples in the Microbiology Unit are performed using validated and accredited (SCC) methodologies, by trained technologists. Quality control measures have been incorporated into the methodologies to ensure that all analytical procedures are functioning properly, minimizing the potential to identify and report false positive or negative results. This report focuses on the quality control implemented during sample analyses. Information regarding the implementation of quality control procedures for sample containers, monitoring of the Pure Water supply, media preparation and storage, equipment monitoring are described by the Laboratory Services Branch (4) and Microbiology Unit Standard Operating Procedures (SOPs), approved Microbiology Methods and Lab Services Branch Quality Assurance Manual (2).

Membrane Filtration

Blank Control Analyses

A control (sterile buffered dilution water) sample is processed between each sample analyzed. The control sample is processed in a manner similar to the regular sample including volume, agar used, incubation time and temperature. The blank control should remain free of any bacterial growth.

Duplicate Analyses

At least one sample in 10 is analyzed in duplicate per day. The data is accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Presence-Absence Procedure

Blank Control Analyses

At least one sample in 10 samples per day includes a blank control sample prepared by adding a 99 mL dilution blank (sterile, buffered dilution water) to P-A broth and incubating it along with the regular P-A bottles. The blank control should remain free of any bacterial growth and there should be no change in the colour of the broth. Identification of growth or colour change in the control blank requires follow-up of sterility checks in both the P-A broth and the dilution blanks.

Heterotrophic Spread Plate

Blank Control Analyses

At least one sample in 10 samples is analyzed per day includes inoculating a Plate Count agar plate with 0.1 mL of sterile buffered dilution water and incubating it along with the regular Plate Count agar plates ($35\pm0.5^{\circ}\text{C}$, 48 ± 3 hours).

Duplicate Analyses

At least one sample in 10 samples is analyzed in duplicate per day. The data is accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Blank Analyses Corrective Action

The presence of bacterial growth on any control sample by the above techniques (Membrane Filtration, PA Broth, Heterotrophic Spread Plate) indicates inaccurate technique. The supervisor must be consulted with regards to determining follow-up and corrective action. Reporting of results may be tempered by the presence of bacterial growth on these control samples and data qualifying remarks codes would be noted on the final report. Records of all control samples are maintained in the laboratory.

3.2 PERFORMANCE SUMMARIES

MICROBIOLOGY

Bacillus thuringiensis israelensis (Bti)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3451	Reporting Unit	CFU/100 mL
LIMS Product Code	BTI3451	Scientist	A. Irwin Abbey
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	sodium thiosulphate

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is filtered through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto Brain Heart Infusion (BFI) agar plate and incubated $28.5 \pm 0.5^{\circ}\text{C}$, for 20 ± 3 hours. Target colonies (clear) formed on the membrane filter are aseptically transferred to 100 µL of molecular water where they are boiled at $100.0 \pm 5^{\circ}\text{C}$ for 10 ± 3 minutes followed by centrifugation at 10,000xg for 10 minutes. A 1 µL volume of this sample is added to 24 µL Master Mix and these samples are then run in a polymerase chain reaction (PCR). Samples exhibiting positive results through PCR are confirmed using gel electrophoresis.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, loop, bunsen burner, incubators, microscope, biological safety cabinet, ABI Prism® 7900HT Sequence Detection System, centrifuges, PCR mix preparation hood, DNA preparation hood, microwave, thermocycler, vortex, heatblock, sterile centrifuge tubes, 96 well optical reaction plates, pipetting devices, pipetting tips, freezers and refrigerators.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR and gel electrophoresis run
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Bacillus thuringiensis israelensis (Bti)

E3451
QUALITY CONTROL DATA FOR 2004 AND 2005
CFU/100 mL

DUPLICATES:

Membrane Filtration Duplicates

Counts per plate	Mean of data	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	7.08	2.06	18	2.19	30.95

Polymerase Chain Reaction Duplicates:

Ct	Mean of data	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
<20	17.02	0.17	12	0.18	1.05
20-30	25.39	0.40	15	0.36	1.40
>30	32.50	1.14	4	1.25	3.85

Bacillus thuringiensis israelensis (Bti)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3452	Reporting Unit	Total <i>Bti</i> / 100 mL
LIMS Product Code	BTI3452	Scientist	S. Weir
Sample Type/Matrix	Drinking Water (WD), Surface Water (WS), or Ground Water (WG)		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	none required (may contain sodium thiosulphate)

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is filtered through a 0.45 µm pore size, cellulose filter, and aseptically removed from the filtration apparatus. DNA is directly extracted from this filter. A 10 µL volume of this DNA extract is added to 15 µL of Master Mix and 1 µL of an internal plasmid probe. These samples are then run using Real-time polymerase chain reaction (PCR) to determine if there are any inhibitors present in the sample that would hinder amplification. If there are inhibitors, samples undergo dilution and, if necessary, a purification step and the above is repeated. If no inhibition is present, a 10 µL volume of the DNA extract is added to 15 µL of Master Mix and samples are run using Real-time PCR. Samples are quantified using a standard curve of calibrated plasmids that are run concurrently.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, microscope, biological safety cabinet, ABI Prism® 7900HT Sequence Detection System, centrifuges, PCR mix preparation hood, DNA preparation hood, thermocycler, vortex, sterile centrifuge tubes, 96 well optical reaction plates, pipetting devices, pipetting tips, freezers and refrigerators.

REPORTING:

Maximum Significant Figures: 2	Current W value: < 60	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR
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Bacillus thuringiensis israelensis (Bti)

E3452
QUALITY CONTROL DATA FOR 2004 & 2005

Total *Bti* / 100 mL

DUPLICATES:

Counts per plate	Mean of data (Log transformed)	Mean Difference (Log transformed)	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
Spiked SuperQ Water	2.96	0.25	31	0.26	8.78
Spiked Raw Water	3.35	0.21	11	0.23	6.87

Escherichia coli (EC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth, incubated ($35\pm0.5^{\circ}\text{C}$, for up to 48 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for *Escherichia coli* are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

***Escherichia coli* (EC)
E3226**

QUALITY CONTROL DATA FOR 2005

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	372	0

Escherichia coli (EC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	EC3371, *TCEC3371,*ECFS3371 *,ECFSPS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

* TCEC3371,*ECFS3371*,ECFSPS3371 are mixed parameter product codes. See individual tests TC,FS,PSA, for details on medium used and incubation.

***Escherichia coli* (EC)
E3371**

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
319	1-19*	1.56	1.74	40.80
132	20-80	5.27	4.55	10.34
36	81-150	7.11	6.21	5.81

* 84 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2393	3

Escherichia coli (EC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TCEC3407	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

***Escherichia coli* (EC)
E3407**

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
20	1-19*	0.30	0.71	94.28
15	20-80	7.67	6.29	12.46
2	81-150	3.5	2.69	2.41

* 16 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	203	0

Escherichia coli (EC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3433	Reporting Unit	CFU /g wet weight
LIMS Product Code	EC3433	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage		

SAMPLING:

Quantity Required:	50g
Container:	WhirlPak™ bag
Preservative:	None

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per gram wet weight of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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Escherichia coli (EC)

E3433

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
45	1-19*	0.84	1.85	115.81
7	20-80	4.43	3.45	10.58
2	81-150	6.50	4.72	5.09

* 24 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	366	5

Fecal Streptococci (FS)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	FS3371,*ECFS3371, *ECFSPS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEnterococcus agar plate and incubated 35±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

ECFS3371,ECFSPS3371 are mixed parameter product codes. See individual tests EC,PSA, for details on medium used and incubation.

**Fecal Streptococci (FS)
E3371**

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

(n) Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
110	1-19*	2.39	2.38	37.33
69	20-80	5.35	4.66	10.83
24	81-150	9	8.49	7.97

* 10 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	708	4

Heterotrophic Plate Count (HPC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3408	Reporting Unit	CFU per 1mL
LIMS Product Code	PC3408	Scientist	R. Schop
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquot is inoculated onto a Plate Count agar plate with a micropipette. The sample is then spread onto the plate using a glass rod and an electronic turntable. The plate is then incubated $35\pm0.5^{\circ}\text{C}$, 48 ± 3 hours and checked for growth. Target colonies formed on the plate are recorded per 1 mL of sample

INSTRUMENTATION:

Micropipette, sterile micropipette tips, sterile glass rod, electronic turntable, incubator, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicates Negative control per run- open air plate Negative control (5% per day) - glass rod check
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Heterotrophic Plate Count (HPC)
E3408

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/1 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
392	1 - 19*	0.30	0.85	107.66
44	20-80	5.09	4.30	11.29
3	81 -150	11.33	8.98	9.23

*346 duplicate pairs with counts per plate of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	772	0

INDICATOR ORGANISMS

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated ($35\pm0.5^{\circ}\text{C}$, for up to 48 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for indicator organisms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators

REPORTING:

Detected/Not Detected per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of indicator organisms. Various media are used in their determinations . See method.

Indicator Organisms

E3226

QUALITY CONTROL DATA FOR 2005

Present/Absent per 100 mL

	n	Number of Confirmed Indicator Organisms
Presumptive Positive	58	37

Pseudomonas aeruginosa (PSA)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	PSA3371,*ECFSPS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mPA agar plate and incubated 41.5±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

*ECFSPS3371 is a mixed parameter product code. See individual test EC, FS for details on medium used and incubation.

Pseudomonas aeruginosa (PSA)
E3371

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

Data Pairs (n)	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
70	1-19*	2.19	5.14	161.67
19	20-80	4.47	3.58	7.79
1	81-150	5	3.54	3.74

* 28 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	514	4

Total Coliforms (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated ($35\pm0.5^{\circ}\text{C}$, for up to 48 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Total Coliforms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

**Total Coliforms (TC)
E3226**

QUALITY CONTROL DATA FOR 2005

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	372	0

Total Coliforms (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	TC3371, *TCEC3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEndo LES agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

* TCEC3371 is a mixed parameter product code. See individual test (EC) for details on medium used and incubation.

Total Coliforms (TC)
E3371

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

Data Pairs	Counts per Plate CFU/100mL	Average of all Data Points	Standard Deviation of the Duplicates	Coefficient of Variation (%)
N.A.	1-19	N.A.	N.A.	N.A.
19	20-80	3.53	3.19	7.06
5	81-150	8.4	6.66	6.43

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	369	0

Total Coliforms (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TCEC3407	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

**Total Coliforms (TC)
E3407**

QUALITY CONTROL DATA FOR 2005

Colony Forming Units/100 mL

DUPLICATES:

(n) Data Pairs	Counts per Filter CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
17	1-19*	0.71	4.76	132.63
15	20-80	5.6	4.99	10.48
5	81-150	11	8.17	0.06

* 8 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	203	0

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ABBREVIATIONS

AAII	- Auto Analyzer Model II
AAS	- Atomic Absorption Spectrophotometer
BL	- Blank
°C	- Degree Centigrade
cm	- Centimetre
CS1	- Check Sample 1
CS2	- Check Sample 2
CFU	- Colony Forming Units
Date	- Month/Day/Year
DO	- Dissolved Oxygen
EDTA	- Ethylenediaminetetra-Acetic Acid, Disodium Salt, Dihydrate
FTU	- Formazin Turbidity Units
g	- Gram
HZU	- Hazen Units
in ²	- Square Inches
IS(n)	- Internal Standard (n denotes parameter)
kg	- Kilogram
L	- Litre
LAB	- Laboratory
LIMS	- Laboratory Information Management System
LTB/L	- Long Term Blank
Icl	- Low Control Limit
lwl	- Low Warning Limit
m ³	- Cubic Metre
M	- Molarity
MB	- Method Blank
meq	- Milliequivalent
mg	- Milligram
min	- Minute
mL	- Millilitre
mm	- Millimetre
N	- Normality
N.A.	- Not Available or Not Applicable
nm	- Nanometre
n	- Number
PC	- Personal Computer
Pure-DW	- Pure Deionized Water

ABBREVIATIONS cont'd

Pure-W	- Pure Water
QC	- Quality Control
QCA	- Quality Control Standard A
QCB	- Quality Control Standard B
QCC	- Quality Control Standard C
QCD	- Quality Control Standard D
R	- Recovery
rpm	- Revolutions Per Minute
RS92	- Reference Standard (in -house)
S	- Between Run Standard Deviation
S ₁	- Standard Deviation (Conventional)
S ₂	- Standard Deviation For Duplicates
S _w	- Standard Deviation Within Run
S. Class	- Weight Classification Designation (not certified)
s.d.	- Standard Deviation
Standard Cal	- Colourimeter setting to control electronic expansion
STD	- Standard
TCU	- True Colour Units
TPTZ	- Ferrous-2,4,6-tri(2'pyridyl)-1,3,5,- triazine
ucl	- Upper Control Limit
uwL	- Upper Warning Limit
μm	- Micrometer
μeq	- Microequivalent
μg	- Microgram
μS	- Micro-Siemen
UV	- Ultra-Violet
V/V	- Concentration based on volume measurements
W40	- Whatman 40 Filters
%	- Percent

Appendix A
W and T values for '02

Parameter	Method Reference No.	Units	Full Scale	W	T
Alkalinity, Total Fixed Endpoint	(E3218)	mg/L CaCO ₃	1000	0.5	2.5
Bromate	(E3434)	µg/L BrO ₃	15	0.2	1.0
Bromide	(E3434)	µg/L Br	30	0.2	1.0
Carbon, Dissolved Inorganic	(E3370)	mg/L C	80.0	0.2	1.0
Carbon, Dissolved Organic	(E3370)	mg/L C	20.0	0.1	0.5
Chloride	(E3004)	µg/m ³ Cl	28.6	0.1	0.5
Chloride	(E3013)	µg/g Cl	-	0.5	2.5
Chloride	(E3016)	mg/L Cl	100	0.2	1.0
Chlorophyll "a"	(E3169)	µg/L	-	0.2	1.0
Chlorophyll "a" Acidified	(E3169)	µg/L	-	1.0	5.0
Chlorophyll "b"	(E3169)	µg/L	-	0.1	0.5
Colour, True	(E3219)	TCU	100	0.2	1.0
Conductivity	(E3218)	µS/cm	2000	1	5
Cyanide, Free	(E3015)	mg/L CN ⁻	0.2	0.001	0.005
		µg/g CN ⁻		0.01	0.05
Cyanide, Total	(E3015)	mg/L CN ⁻	0.2	0.001	0.005
Cyanide, Total	(E3015)	µg/g CN ⁻		0.01	0.05
Fluoride	(E3172)	mg/L F	2.0	0.01	0.05
Nitrate	(E3004)	µg/m ³ NO ₃	28.6	0.1	0.5
Nitrilotriacetic Acid	(E3406)	mg/L NTA	1.00	0.01	0.05
Nitrogen,					
Ammonia Plus Ammonium	(E3364)	mg/L N	2.0	0.002	0.01
Ammonia Plus Ammonium	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrate Plus Nitrite	(E3364)	mg/L N	5.00	0.005	0.025
Nitrogen, Nitrate Plus Nitrite	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrite	(E3364)	mg/L N	0.200	0.001	0.005

Appendix A
W and T values for '02

Parameter	Method Reference No.	Units	Full Scale	W	T
Nitrogen, Nitrite	(E3366)	mg/L N	2.00	0.005	0.025
Nitrogen, Total Kjeldahl	(E3116)	mg/g N	20	0.1	0.5
Nitrogen, Total Kjeldahl	(E3118)	mg/g N	100	0.20	1.00
Nitrogen, Total Kjeldahl	(E3367)	mg/L N	2.00	0.02	0.10
Nitrogen, Total Kjeldahl	(E3368)	mg/L N	50.0	0.05	0.25
Oxygen Demand, Biochemical	(E3182)	mg/L O	9.0	0.2	1
Oxygen Demand, Chemical	(E3170)	mg/L O	50	1	5
Oxygen Demand, Chemical	(E3246)	mg/L O	400	2	10
pH	(E3218)	-	-	-	-
Phenolics, Reactive	(E3179)	µg/L Phenol	50.0	0.2	1.0
Phosphorus,					
Reactive ortho-Phosphate	(E3364)	mg/L P	0.100	0.0005	0.0025
Reactive ortho-Phosphate	(E3366)	mg/L P	10.0	0.02	0.10
Phosphorus, Total	(E3116)	mg/g P	2	0.02	0.10
Phosphorus, Total	(E3118)	mg/g P	25	0.02	0.10
Phosphorus, Total	(E3367)	mg/L P	0.200	0.002	0.01
Phosphorus, Total	(E3368)	mg/L P	10.0	0.02	0.10
Silicon, Reactive Silicates	(E3370)	mg/L Si	10.0	0.02	0.10
Solids, Dissolved	(E3188)	mg/L	-	2	10
Solids, Suspended	(E3188)	mg/L	-	0.5	2.5
Solids, Suspended Ignited	(E3188)	mg/L	-	0.5	2.5
Solids, Total	(E3188)	mg/L	-	2.0	10.0
Solids, Total Ignited	(E3188)	mg/L	-	2.0	10.0
Sulphate	(E3004)	µg/m³ SO₄	28.6	0.1	0.5
Sulphate	(E3013)	µg/g	1000	0.5	2.5
Sulphate	(E3172)	mg/L SO₄	100	0.5	2.5

Appendix A
W and T values for '02

Parameter	Method Reference No.	Units	Full Scale	W	T
Sulphide	(E3100)	$\mu\text{g/L S}^{2-}$	100	2.0	10.0
Turbidity	(E3311)	FTU	2000	0.05	0.25



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Wong, Priscilla

Performance report

General Chemistry and
Microbiology section C.I. a aa